MONTHLY WEATHER REVIEW,

NOVEMBER, 1880.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to December 14th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 144 Signal Service stations and 15 Canadian stations, as telegraphed to this office; 166 monthly journals and 157 monthly means from the former, and 15 monthly means from the latter; reports from 3 Sunset stations; 226 monthly registers from Voluntary Observers; 32 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Service of, Missouri; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon chart No. II is shown, by the isobaric lines, (in black) the distribution of atmospheric pressure over the United States for November, 1880. On the Pacific Slope an area of unusually high pressure prevailed over Oregon and Washington Territory, the mean being above 30.30 at all Oregon stations. An area of very high pressure covered the Middle States and the Ohio valley and Tennessee, the mean ranging in these districts from 30.22 to 30.29. Except at the Rocky Mountain stations, in the Plateau districts, the South Atlantic and Eastern Gulf States, the mean pressures have been decidedly greater than have ever before been recorded by this Service in November.

Departures from Normal Values for the Month.—By comparison with the average for seven years it is found that the barometric pressure for November, 1880, except in the Plateau and Rocky Mountain districts (where the departures from the normal have been slight and unimportant,) has been very decidedly above the average. The excess in New England, the Middle States, the Lower Lake region and the Ohio valley has ranged from 0.16 inch to 0.20; elsewhere, except along the immediate Gulf coast, it varied from 0.10 to 0.19. On the Pacific coast the excess was 0.08 at San Diego, 0.12 at San Francisco and 0.20 at Portland.

The Local Barometric Ranges, from readings reduced to sea-level, have, during November, 1880, been greater than usual. These ranges, eastward of the 102nd meridian, as a rule, increase from the coast toward the interior so that lines of equal ranges are generally parallel to the sea coast. In the Gulf States the lines deviate slightly from this rule and trend from the northeast to the southwest—the fluctuations in Texas being decidedly greater than in Florida. The local ranges for the month decrease gradually along the Gulf coast from 0.92 at Indianola to 0.36 at Punta Rassa and Key West. Along the Atlantic coast they increase gradually from 0.51 at Jacksonville to 1.23 at Portland, Me. The greatest fluctuations occurred over the Lake region and the Ohio valley; greatest ranges, 1.44 inches at Marquette, 1.45 at Columbus, 1.48 at Madison and Rochester and 1.50 at Buffalo. In the elevated plateaux of the country the range increases quite regularly with the latitude, while on the Pacific Slope the lines of equal ranges trend from northwest to southeast, indicating that the range increases with latitude and elevation. The greatest ranges on that coast were 1.19 at Olympia and 1.42 at Umatilla.

General Barometric Range.—The extreme range of the atmospheric pressure, reduced to sea-level, was 1.75 inch, from 30.86 at Cincinnati on the morning of the 22nd, to 29.11 at Father Point on the afternoon of the 7th.

Areas of High Pressure.—Nine such areas have prevailed during November, 1880, two of these areas were encroachments of the area of high pressure from the North Pacific ocean. No. VI appears to have been formed by an encroachment of high pressure from the Pacific ocean together with an outflow from Saskatchawan. No. III appeared first in Texas, although it may have moved eastward from the Plateau districts. Nos. III, VII and VIII were especially noted for the unusually high pressures and very low temperatures for the season. In consequence the pressure has been abnormally high and the temperature proportionally low.

No. I.—This area, described as No. IX in the October REVIEW, moved from the Gulf States northeastward and, reinforced by rising pressure in Canada, covered the North Atlantic States and the Canadian Maritime Provinces until the morning of the 5th, when it gradually dissipated. The highest pressure reported was on the morning of the 5th, at Sydney, Nova Scotia, 30.64 or 0.73 above the normal. During the prevalence of this area cloudy and rainy weather, with brisk easterly winds, continued in the South and Middle Atlantic States. During its eastward movement Cautionary Signals were displayed on Lake Erie on the 1st, which were followed by westerly winds, with hourly velocities ranging from 26 to 29 miles on that lake. During the 3rd and 4th, Cautionary Signals were displayed from Smithville northward to Portland. These signals were lowered during the 5th, having been generally justified. The following maximum velocities were reported: Wood's Holl, SE. 26 miles; Barnegat and Sandy Hook, SE. 36; Cape Hatteras, SE. 39; Kittyhawk, SE. 46; Cape Lookout, E. 50.

No. II.—The pressure gradually increased on the Pacific coast during the 3rd; Olympia barometer at midnight 0.38 above the normal. On the morning of the 4th the highest pressure of the area was at Ft. Keogh, 0.46 above the normal; during the day the area gradually dissipated.

No. III.—During the 6th the pressure in the Gulf States rose slightly above the mean; Eagle Pass barometer that afternoon 0.21 above the normal. The area withdrawing slowly eastward covered the Atlantic Slope during the 8th and 9th and united on the 10th with area No. V. At midnight of the 5th Cautionary Signals on the Texas coast were changed to Off-shore and were lowered on the 6th; Indianola, NW. 36; Galveston, N. 32.

No. IV.—During the 7th the pressure increased along the North Pacific coast. On the afternoon of the 8th the Olympia barometer was 0.31 above the normal. The area rapidly dissipated. Occasional rain fell during the 7th in Oregon and Washington Territory.

No. V.—During the 9th the pressure rose above the normal in the Northwest; Fort Garry barometer at midnight 0.37 above the normal. Moving slowly eastward it apparently united on the 10th with high area No. III in the St. Lawrence valley where, on that afternoon, the highest reading of the area was reported from Quebec, 0.47 above the normal. Subsequently it dissipated or withdrew eastward in advance of low area No. V. In connection with this area and low area No. III signals were displayed on Lake Michigan and the eastern half of Lake Superior from the afternoon of the 6th to the afternoon of the 7th. These signals were partly justified by a west wind of 28 miles at Grand Haven. Cautionary Signals were displayed during the 9th and the morning of the 10th along the North Carolina coast, and were lowered the morning of the 11th. These signals were justified by the following hourly velocities: Norfolk, SE. 26 miles; Cape Lookout, SE. 33; Cape Henry, SW. 36, and Cape Hatteras, S. 40. Near Smithville a schooner was driven ashore by the gale.

No. VI.—During the 9th the pressure rose rapidly along the North Pacific coast where by the afternoon of the 11th the barometer at Olympia stood 30.63 or 0.60 above the normal. The pressure continued nearly stationary in Washington Territory at 0.50 above the normal until the 17th when it gradually dissipated. During this time the highest pressure in California did not exceed 0.30 above the normal until the 14th, when the barometer was 0.41 above at Sacramento and 0.33 above at Yuma. On the same date the highest pressure of the area was reported from Umatilla, 0.72 above the normal. On the 11th a portion of this area covered the Missouri valley. During the 12th the area extending farther eastward by midnight had raised the pressure above the normal over the entire country, except the Canadian Maritime Provinces. On the morning of the 13th the highest pressure east of the Rocky Mountains was at Ft. Garry, 0.63 above the normal. During the 14th the eastern half of this area gave way before low area No. VII, but again covered the Ohio valley during the 16th as that area moved eastward. By the morning of the 17th the main area had moved eastward of the Rocky Mountains and was central at midnight in Indian Territory; Ft. Gibson barometer 0.60 above the normal. Moving gradually eastward the southern portion of the area dissipated in the Gulf States during the 18th, while the northern half withdrew eastward to the Canadian Maritime Provinces, where it dissipated on the 20th. On the morning of the 13th Cautionary Signals were ordered for the North Carolina coast, and fully justified, were continued during the 14th in connection with low area No. VI. Signals were displayed on the Texas coast from the 12th to the 14th, part of the time as Cautionary and part as Off-shore. Northerly winds, ranging from 29 to 34 miles, were subsequently reported. As this area moved eastward and low area No. VII passed, Cautionary Signals were ordered somewhat late on the 18th from Ft. Macon to Sandy Hook, and Cautionary Off-shore from New Haven to Portsmouth N. H. They were all lowered on the 19th, fully justified. The following velocities were reported: Boston, NW. 30; Shoreham, Wood's Holl and Thatcher's Island,

NW., 40; Kittyhawk and Cape Henry, NE., 40; Cape May, NW., 45. The passage of this area was marked by minimum temperatures of the month in Florida, the Gulf States, the greater part of the Plateau districts and the Southern Rocky Mountain Slope. These temperatures as is shown elsewhere were in the Gulf States lower than ever before recorded in November. In connection with the approach of this area predictions of frosts were made for the sugar growing districts. These forecasts were unfortunately verified and it is estimated that one-tenth of the sugar crop was lost thereby, although much cane was saved by "wind rowing" it after the warnings were given. Ice formed throughout the greater part of the sugar-growing district in Louisiana during the 18th and 19th. The passage of this area was nearly identical with that of November 26th to 30th, 1877, which, differing but slightly from the present month, furnished a record of the lowest known November temperatures,(except at isolated stations) for the Southern States.

No. VII.—This area, the most important of the month, was apparently an outflow of dry cold air from Saskatchawan or Manitoba. During the 20th the pressure rose rapidly in the Missouri valley and at midnight was central in Missouri; Omaha and Leavenworth barometers 0.39 above the normal. Moving slowly eastward the pressure was increased by an additional outflow of cold air from Hudson's Bay Territory, so that while the centre remained nearly stationary in the Ohio valley during the 22nd and 23rd the pressure at Cincinnati rose to 30.85 or 0.67 above the normal, the highest pressure ever noted at that station. As this area withdrew eastward from the Ohio valley to the Middle States during the 23rd, advancing high area No. VIII united with it. Its subsequent history is considered as that of No. VIII. Cautionary Signals were ordered for the North Carolina coast and having been justified were continued until the 26th in connection with high area No. VIII. The passage of this area was marked by minimum temperatures for the Lake region, the Atlantic States, the Ohio, Upper Mississippi and Lower Missouri valleys. Except in New England, these temperatures were remarkably low for November. They occurred from seven to eight days earlier in the month than the remarkably low temperatures of 1875. The most notable temperatures observed at Signal Service Stations were Washington, 12°.5; Philadelphia, 10°; St. Louis and Louisville, 8°; Pittsburgh, 4°; Buffalo, 3°; Chicago, 1°; Erie, Detroit, Sandusky, Grand Haven and Des Moines, 0°; Champaign, —3°; Alpena, —4°; Columbus, Indianapolis, Keokuk and Milwaukee, —5°; Port Huron, —6°; Marquette, —9°.

No. VIII.—This area, advancing from Manitoba during the 23rd, but for intervening low area No. XIII, might have been considered as a part of high area No. VII. On the 24th the highest pressure was over Minnesota, (St. Paul barometer at midnight 0.54 above the normal) while that of high area No. VII was over New England. As the low area above-mentioned moved northeastward this area gradually followed and merged with high area No. VII. Withdrawing slowly eastward over the Canadian Maritime Provinces it dissipated during the 27th and 28th in advance of low area No. XV. The western portion of this area extended to the Pacific coast, where the pressure remained considerably above the normal until midnight of the 27th. Cautionary Signals displayed for high area No. VII on the New England coast were continued during the 25th and at midnight additional signals were ordered somewhat late from Cape May to Chincoteague. These signals were all lowered by the morning of the 27th. The following wind velocities were reported: Delaware Breakwater, N. 32; Cape Lookout, N. 43; Kittyhawk, N. 50.

No. IX.—During the 28th the pressure rose rapidly in the Northwest and by the morning of the 29th an area of high pressure, central in the Lower Missouri valley, extended southward from Manitoba to Texas. The highest pressure of the area was reported from Cincinnati at midnight of the 29th, being 0.36 above the normal. Withdrawing northeastward it covered the Canadian Maritime Provinces at midnight of the 30th.

Areas of Low Pressure.—Sixteen areas are described for November, 1880. Eleven of these areas have followed tracks sufficiently well defined to permit the charting of them. Of these areas, Nos. III, VI and XI, were possibly of cyclonic origin. Four originated in the Rocky Mountain districts, one developed in Minnesota, and the remaining areas probably formed in Saskatchawan or Hudson's Bay Territory. No area, except possibly No. V, originated on the Pacific coast. Nos. III, V, VII and X, were storms of marked and unusual violence in the Lake region, and caused the loss of many lives and destruction of many vessels. The severity of the storms in the early part of the month on Lake Ontario, may be inferred from the statement that during the first twelve days of the month the crew of the Oswego life-saving station rescued forty-five persons, thirty-nine of whom were saved from wrecks. No. XI proved to be an unusually severe storm along the New England coast, the Canadian maritime Provinces and Newfoundland. The extreme violence of these storms has in a large measure been occasioned by the rapidity with which the low areas have been followed by areas of high pressure.

No. I.—This disturbance, probably developing in Manitoba, extended southeastward during the 1st, and covered on the morning of the 2d the Lower Missouri valley. On the morning of the 3d a trough of low pressure extended southward from Manitoba to southern Texas, with no well-defined centre. The lowest pressure of this area was reported on that afternoon from Yankton, 0.37 below the normal. It merged during the 4th into low area No. II.

No. II.—During the 2d and 3d the pressure was considerably below the mean from the Mississippi valley westward to the Rocky Mountain slope. This disturbance, central the afternoon of the 3d in southwestern Texas, moved northeastward and united with low area No. I during the 4th in Missouri; lowest pressure that afternoon, at St. Louis, 0.32 below the normal. By the morning of the 5th its centre had passed northeastward over Lake Michigan into Canada. Cautionary signals were ordered for Lake Michigan the afternoon of the 3d, and for the rest of the Lake region during the 4th. The signals on Lakes Superior and Michigan were lowered at midnight of the 5th, but remained displayed at the remaining Lake stations in connection with advancing low area No. III, with which they are treated. The following maximum wind velocities were reported in connection with this area: Milwaukee, W. 25; Duluth, NW. 32; Erie, S. 32. Cautionary signals were ordered for the Texas coast on the morning of the 3d and, justified, were changed during the 5th to Off-shore.

No. III.—This storm, which was one of marked and unusual violence in the Lower Lake region, was possibly of cyclonic origin. At midnight of the 5th a sharp barometric fall was reported from the central coast of the Gulf States; New Orleans and Mobile barometers 0.22 below the normal. On the morning of the 6th a trough of decreased pressure extended from Alabama northward to Ohio; Knoxville, Nashville and Columbus barometers 0.34 below the normal. During the day the pressure rapidly decreased, being that afternoon 0.60 below the normal at Columbus, and at midnight 0.86 below at Kingston. Moving rapidly northeastward it was central in the Lower St. Lawrence valley on the morning of the 7th, and later in the day passed over the Gulf of St. Lawrence. At midnight of the 5th signals displayed for area No. II were continued on the Lower Lakes, and all stations were warned of this advancing storm. This storm, in connection with advancing high area No. III, was unusually severe in the Lower Lake region and New England. The storm on Lake Erie was said to have been the worst for 30 years. Rain or snow, with northerly backing to westerly gales prevailed, with wind-velocities as follows: Sandusky W. 43; Erie NW. 44; Toledo W. 44. At Toledo many vessels warned remained in port; all venturing out were obliged to put in for shelter; and one was lost. Two schooners and three barges were driven ashore, and others were severely damaged. On Lake Ontario the storm was even more severe. During the 7th the wind attained velocities of W. 36 at Oswego; W. 44 at Rochester and W. 60 at Buffalo. On that morning the propeller *Zelanda* foundered; crew, 16 in number, all lost. One schooner and crew of seven, were lost, and one passenger steamer and one schooner missing, probably lost. Four other steamers, one barge and one scow, were driven ashore and several vessels badly damaged. Many vessels remaining in the harbor at Buffalo escaped the storm; all others leaving port were driven back badly damaged. At Buffalo the storm was very violent, doing considerable damage to property; the mean hourly velocity of the wind for the twelve hours preceding 12 m. of the 7th, was 43 miles. Part of Main street was submerged by high water. At Utica the storm was very violent, unroofing a church and damaging other property. A violent thunder-storm occurred at Poughkeepsie at 2 p. m. of the 7th. During the morning violent gales occurred at Toronto and the greater part of the province of Ontario. Much damage was done to houses and other buildings at Canandaigua, Palmyra and other portions of western New York. During the 6th Cautionary Signals were displayed along the Atlantic coast from North Carolina to Maine, and were changed later from Cautionary to Off-shore, from Cape Hatteras to Portland; they were lowered at the afternoon and midnight reports of the 7th; these signals were fully justified by southeasterly veering to northwesterly gales, with the following maximum velocities: Portland SE. 31 and NW. 34; Boston W. 32; Eastport S. 36; Shoreham SW. 36; Cape Hatteras NW. 36; Kittyhawk SW. 44; Wood's Holl NW. 42 and SW. 45; Cape May W. 62. Very severe weather was reported from Long Island Sound and off the New England coast. At Thatcher's Island the Signal-Office building was unroofed by the gale. Strong westerly gales prevailed in the Canadian Maritime Provinces during the 8th; Father Point wind in the afternoon and midnight W. 55 miles. During the 7th and 8th, strong westerly gales and high seas were reported by incoming European steamers.

No. IV.—This area appeared in the extreme Northwest on the morning of the 6th; Bismarck barometer, on that afternoon, 0.35 below the normal. By midnight the area had filled up or merged into low area No. III.

No. V.—During the 6th the pressure fell rapidly on the North Pacific Coast and on the morning of the 7th the barometer at Olympia was 0.17 below the normal. The centre, considerably to the northward of the Signal Service stations, by a southeasterly course, reached northern Dakota on the morning of the 8th; Bismarck barometer 0.52 below the normal. At that time, an extensive trough of low pressure covered the country from the Plateau districts eastward to the Mississippi valley. During the day, the pressure rose in the Missouri valley, and the centre of this area moved due south to northern Texas, where it was central the afternoon of the 9th. Changing its course to north-northeast, it was central with decreasing pressure, the morning of the 10th in Iowa; (Keokuk barometer 0.63 below the normal,) and on the morning of the 11th in northern Michigan; Marquette barometer 0.66 below normal. Changing its course to the eastward through Canada, considerably to the north of the Signal Service stations, it reached the Gulf of St. Lawrence the afternoon of the 12th. Cautionary Signals were ordered for the Texas coast during the 8th, and were changed, as the area moved eastward, to Off-shore. Maximum velocities of SW. 40 and NW. 40, were reported from Indianola. Cautionary Signals were displayed at Pensacola on the 9th, justified by a wind of

SW. 25 miles. Considerable damage was done to vessels in Pensacola harbor. As this area moved northeastward from Texas at midnight of the 9th, Cautionary Signals were displayed on Lake Michigan, and were ordered the following morning for the rest of the Lake region and along the Atlantic coast from Chincoteague to Wood's Holl. These signals were changed to Off-shore on the New Jersey coast, the morning of the 11th, and along the New England coast, the morning of the 12th. They were lowered during the 12th, as follows: On Lakes Superior and Michigan, in the morning, Lakes Huron and Erie, Long Island Sound and the New Jersey coast in the afternoon, and at the remaining stations at midnight. These signals were all fully justified; the greatest wind velocities reported were, as follows: Duluth, NW., 32; Alpena, NE., 33; Cleveland and Erie, SW., 34; Buffalo, W., 37; Milwaukee, SW., 34; Thatcher's Island, SE., 33, and W., 33; Shoreham, SE., 34, and W., 32; Eastport, SE., 34; Wood's Holl, W., 44, and NW. 44. This gale was very severe in the Lake region, along the New England coast, and in the Gulf of St. Lawrence. The wind velocities at Father Point on the 13th, were, as follows: a. m., W.50; p. m., W., 44; m., NW., 40. On Lakes Erie and Ontario, in addition to the foundering of the schooners *Norway* and *Morning Star*, by which 15 lives were lost, many vessels were seriously damaged and a number driven ashore.

No. VI.—At midnight of the 13th, decreasing pressure was reported from the South Atlantic States, where, on the morning of the 14th, Jacksonville barometer was 0.06 below the normal. This area probably moved northward, not far from the South Atlantic coast. Sudden squalls, damaging the bark *O. C. Clary* in 32° 25′ N., 72° 30′ W., on the 14th, were reported. Vessels arriving at Smithville, reported a hurricane at sea on the 15th. At midnight, the barometer at Cape Hatteras was 0.23 below the normal, while high northerly winds, accompanied by heavy rain, prevailed along the South Atlantic coast. During the 15th, the area probably moved northeastward towards Nova Scotia. During the 14th, Cautionary Signals displayed along the North Carolina coast for high area No. VI were continued and Cautionary Signals were ordered from Norfolk to Sandy Hook. These signals were lowered in the afternoon of the 15th, having been justified by the following maximum velocities: Cape May, N., 26; Cape Henry, N., 28; Smithville, SE., 36; Kittyhawk, NE. 44.

No. VII.—moved southeastward from Manitoba and on the morning of the 15th was central in Minnesota; Duluth barometer 0.48 below the normal. The centre continued in a southeast course and passing over Lake Michigan, was central, with increased pressure in southern Michigan the morning of the 16th, whence it passed northeastward into Canada during that day. Cautionary Signals were ordered for the Upper Lake region at midnight of the 14th and for the stations on the other Lakes, except Ontario the following day. They were lowered on the Upper Lakes during the 15th and at the Lower Lake stations on the following morning. These signals were justified by rough weather and high winds, the schooner *E. M. Carrington* being lost, with a crew of five on Lake Michigan, and three vessels foundered or totally wrecked (crews saved,) on Lake Erie. The following are some of the maximum velocities which were reported: Buffalo, SW. 25; Toledo, SW. 27; Marquette, W. 27; Duluth, NW. 30; Grand Haven, NW. 32; Port Huron, W. 33.

No. VIII.—During the 15th the barometer fell very rapidly in California and the Southern Plateau districts, and by the morning of the 16th an extensive area of low pressure covered these districts and southwestern Texas. The lowest pressures connected with this area, occurred as follows: Ft. Yuma, 0.22 below the normal; Prescott, 0.24 and Santa Fe, 0.25 below, the afternoon of the 16th, at which time the lowest pressure also occurred at Silver City and La Messilla. Its course eastward being apparently prevented by high area No. VI, it withdrew westward to California; San Francisco barometer at midnight 0.23 and Visalia 0.24 below the normal. During the prevalence of this area clear weather was reported from California, Nevada and Arizona. On the Colorado desert, near Mammoth Tank, violent sand storms occurred during the 16th, suspending all railway travel for 16 hours.

No. IX—This area suddenly appeared in the St. Lawrence valley on the morning of the 18th, and moving through Maine, by midnight had passed eastward, with decreasing pressure beyond the Cape Breton coast, where the lowest pressure was then reported, 0.38 below the normal at Sydney.

No. X.—During the 18th the pressure gradually decreased over the Plateau regions, and by midnight this area was central in Nebraska; Cheyenne barometer, 0.23 below the normal. Moving northeastward the centre on the morning of the 20th, was over the eastern end of Lake Superior, whence it passed eastward, with increasing violence through Canada and reached the St. Lawrence valley at midnight. On the morning of the 21st, it united over the Gulf of St. Lawrence, with low area No. XI. On the morning of the 20th, Cautionary Signals were ordered for Lakes Michigan, Huron and Erie and that afternoon for Lake Ontario. These signals were lowered on the 21st in the Upper Lake region and on the following morning at the Lower Lake Stations. This storm was unusually severe over Lake Ontario, where four vessels were wrecked and ten more badly damaged. At Buffalo one vessel was sunk and one person drowned. The following maximum velocities were reported: Marquette, W. 26; Milwaukee, W. 36; Alpena and Port Huron, W. 34; Erie, SW. 42; Oswego, W. 33; Buffalo, W. 37.

No. XI.—During the night of the 19th and 20th, the pressure decreased rapidly along the South

Atlantic coast. On the morning of the 20th the barometric fall extending northward, became more sudden and marked; New London barometer 0.34 below the normal (a fall of 0.39 in eight hours) Cape Hatteras barometer 0.31 below the normal (a decrease of 0.20 in eight hours.) The lowest pressure connected with area No. X was then 0.30 below the normal at Parry Sound. At midnight this area was central over the Bay of Fundy, with the following decrease of pressure reported for the past eight hours: Sydney, 0.38 inch; Father Point, 0.39; Chatham, 0.50; Halifax, 0.59; Eastport, 0.61 and Yarmouth, 0.71. On the morning of the 21st the area united with No. X over the Gulf of St. Lawrence: Sydney barometer 29.29 or 0.61 below the normal (a fall of 0.71 in eight hours and 1.09 in sixteen hours.) Cautionary Signals were displayed during the 20th for New England and the North Carolina coast, and were lowered, in the latter district, at midnight. Cautionary Off-shore Signals were also ordered for the New Jersey coast. In New England, except for Eastport, these signals were later changed to off-shore. These signals were lowered on the New Jersey coast on the morning of the 21st, but were continued at the remaining stations until the morning of the 22nd. This storm was one of unusual violence off the New England coast, the Canadian Maritime Provinces and off the Banks of Newfoundland, continuing in the latter district until the 25th. A dispatch from St. John's, N. F., reports that over thirty vessels were lost; fourteen in Bona Vista harbor, six in Conception Bay, several in Green Bay. The following are some of the wind velocities reported: Portland, W. 31; Shoreham, NW. 42; Boston, W. 44; Wood's Holl, NW. 44; Thatcher's Island NW. 40; Yarmouth, N. 55; Father Point, 21st, a. m., W. 48, p. m., W. 84, m., W. 65; 22nd, a. m., W. 54, p. m., W. 60, m., W. 48.

No. XII.—During the 22nd and 23rd, the pressure fell gradually over Nevada; on the morning of the 24th, Pioche barometer 0.31 below the normal. Apparently withdrawing southeastward into New Mexico, the area gradually filled up during the 25th. As a portion of this area extended into Texas, Cautionary Signals were ordered for that coast on the 24th, but were not justified.

No. XIII—formed between high areas Nos. VII and VIII. Central at midnight of the 23rd over Lake Superior it moved nearly due east, and passing through Maine, was central over the Gulf of St. Lawrence on the afternoon of the 25th. A marked feature of this area consists in the fact that the lowest pressures during its passage were 0.19 *above* the normal at Marquette on the morning of the 24th, and 0.13 *above* at Halifax the afternoon of the 25th. Cautionary Signals were displayed on Lakes Michigan, Huron and Erie during the 24th, but were justified only on Lake Huron; Alpena, S. 25; on that lake the storm was very severe, and the Steamer *Simcoe* foundered, twelve men lost.

No. XIV.—During the 26th the pressure decreased slowly over the Plateau region; Pioche barometer, the morning of the 27th, 0.33 below the normal. Extending slowly eastward with slightly increased pressure, the area, on the morning of the 28th, in the shape of a trough, covered New Mexico, western Texas and northern Arizona, with the lowest pressure at Fort Stockton, 0.25 below the normal. Subsequently the area gradually filled up.

No. XV.—This area apparently developing in Manitoba where it was central at midnight of the 27th, following an easterly path passed down the valley of the St. Lawrence during the 29th. While passing eastward its centre skirted the northern limits but at no time entered the confines of the United States. Signals were displayed, somewhat late, at Grand Haven.

No. XVI.—This area probably developing in Saskatchawan, was in northern Montana on the morning of the 30th. It moved slowly eastward and was central, at midnight, in northeastern Dakota; St. Vincent and Fort Stevenson barometers 0.69 below the normal.

INTERNATIONAL METEOROLOGY.

Three International charts, Nos. IV, V and VI, accompany the present Review. They are for the months of *October*, 1880 and *March*, 1879.

Chart No. IV.—This is a *preliminary* chart, and indicates, as well as is at present (Dec. 10, 1880,) possible, the tracks of some of the principal storms over the North Atlantic Ocean and adjacent land areas during the month of *October*, 1880. The meteorological conditions over the North Atlantic Ocean during this month were characterized by very severe storms, all those indicated on the chart having been accompanied by hurricane winds. The general position of the tracks is much more to the south than usual, and noteworthy peculiarities are found in the small number traversing the region of Newfoundland, (reports from St. John's and Heart's Content not yet to hand,) and in the narrow limits within which an unusually large number of storms arrived on the western coast of Europe, not less than five severe storms arriving at the entrance of the English Channel during the month, namely, on the 5th, 7th, 20th, 22d and 27th. In conformity with this distribution of the storm-centres, the weather over the British Isles was marked by cold northeasterly winds and heavy rains, the latter resulting in disastrous floods and the former reducing the average temperature several degrees below the normal value: Thus, for the week ending October 25th, the temperature deficit in the several districts, (see *Weekly Weather Report*, issued by the Meteorological Office, London,) ranged from 8° to 11° Fahr. For the same reason easterly winds prevailed, almost without intermission, over the ocean north of the 45th parallel throughout the entire month. As yet no storm-centre for this month

can be traced entirely across the Atlantic, although the areas Nos. VII and VIII were in all probability the same low area. Areas Nos. I, III and VI, and probably IX and XI, were tropical hurricanes. No. I passed north, to the eastward of the Bermudas, during the 2nd. Below are given in condensed form, reports from about 25 vessels, of observations, made during the 1st, 2nd, 3rd and 4th, and arranged according to latitude:

October 1st.			October 2nd.			October 3rd.			October 4th.		
N.	W.	Hurricane from—	N.	W.	Hurricane from—	N.	W.	Hurricane from—	N.	W.	Hurricane from—
25	63	——	27	64	ENE.-E.-calm-SW.; centre at 1:30 a. m.; barometer 27.40.	34	57	——	37	55	SSE.-NE., 5 hours.
26	64	E. to NW., 12 hours.				35	50	SE.-NE.	38	54	ESE.-ENE.
27	63	SW.	27	66	NNE.-SW., several hours.	35	56	SE.-NW., 12 hours.			
27	63	——, 2 hours.	28	68	SW. and W.; centre at 8 a. m.; barometer 27.40.	35	57	NE.			
27	64	ENE. to E.				35	59	——			
28	64	——	29	63	——	36	55	——, 10 hours.			
			30	64	SSE.-NE., 14 hours.	36	58	E.-N., 5 hours.			
			32	64	SE.-WNW., 4 hours.	37	56	SE. to WNW., 3 hours.			
			32	64	NE-SE., 7 hours.	37	56	NNE.			
						37	58	SE. to NW.			
						38	54	SE. to NE. and NNW.			

This storm appears to have died out on the 4th over mid-ocean. No. II is a continuation of area No. XIV. (chart IV, October REVIEW). From the 1st of October to the 5th, it moved slowly eastward from the Azores to the mouth of the English channel as a severe storm, and thence, during the 5th and 6th, with decreased energy, to the Baltic, where it appears to have dissipated. Over the Atlantic, the centre of this storm was closely followed by the S. S. *Nederland*, as shown by the following observations:

Date.	N.	W.	Barometer.	Wind (0—12.).
3rd.....	47	29	29.35	NE. 6, rain.
4th.....	48	26	29.67	NE. by E. 10, stormy.
5th.....	48	22	29.82	NE. by N. 10, stormy.
6th.....	49	18	29.76	NNE. 8, squally.
7th.....	49	13	29.56	NNE. 10, storm.

The fall of the barometer, during the 6th and 7th, was due to the formation of a secondary depression off the mouth of the channel on those days and which appears to have remained almost stationary over this region as a severe storm until the 10th, when it dissipated near Cherbourg. The track of this latter storm is not charted. No. III is a continuation of the low barometer area No. IV, already described in the October *Review*. In the absence of more definite data, the following remarks by Mr. Chas. Hasselbrink, of Havana, Cuba, may be of interest in regard to the early history of this storm. On the 2nd of October he reported:—"Since September 28th, we have been feeling the effects of a storm; although the symptoms have not precisely the typical characters of a cyclone, yet the wind blew fresh from NW. on September 28th and 29th, then from NE. and now from E"; and on the 9th of October, "after the 2nd, we had a few dull, calm days, when the storm (cyclone) was probably most distant from us, but on the 5th, the barometer commenced to fall, probably by the cyclone recurving at that time, and having, on the 6th, entered the second branch of its parabolic course, and coming nearer to us, we, on that day, fell more under its influence," "7th, signs of cyclone perhaps more accentuated." On the 8th, the centre passed over northern Florida, and during the 9th, 10th and 11th thence eastward and to the south of the Bermudas as a severe hurricane. The following mark its journey eastward:

October 8th.			October 9th			October 10th.			October 11th.		
N.	W.	Wind.	N.	W.	Wind.	N.	W.	Wind.	N.	W.	Wind.
30	80	SE. gale.	33	76	SE. to N. hurricane; cyclone 9 hours.	34	67	E. hurricane.	29	69	NE. gale, 24 hours.
29	79	SSE. hurricane.							33	66	NE., furious gale.
33	75	ENE. hurricane.	36	74	E. gale.				26	66	SW. to N. gale.
32	74	E. gale.							33	63	Hurricane from 10 a.m. to 12th.
									32	52	ESE. gale—Calm—N. hurricane.

The *Bermuda Gazette*, October 12th, states: "October 10th, Sunday, a cyclone evidently passed southwest of us, giving us, however, only a deluge of rain, nearly 2½ inches, (at Gibb's Hill Light station, at southern extremity of Islands, 5.74 inches were measured from the 9th to the 11th, with thick squally weather and on the 11th, NE. fresh gales) and a heavy sea swell," and "on Monday another cyclone passed east of Bermuda." The latter was, however, probably the same storm passing to the easward, the lowest barometer reading at Gibb's Hill Light occurring on the morning of the 11th—29.70; weather very unsettled and wind NE. No. IV. appeared over mid-ocean on the 9th; on the 10th it developed hurricane strength between 40° and 50° N. and in about 40° W., and appears to have moved in a northerly path. On the 9th bark Sir G. F. Seymour, in 38° N. 37° W., had heavy gale from SSE. hauling to WNW. and moderating. Hurricane winds were experienced on the 9th and

10th in 36° N., 39° W., by steamer Ferdinand von der Taelsen; on the 10th in 45° N., 37° W., by steamer Cyanus; in 46° N., 34° W., by steamer Inchmaree and in 47° N., 41° W., by barque Margaret, the latter vessel reporting barometer 29.20. On the 11th steamship Oder, in 47° N., 44° W., had severe gale and heavy seas from NE. and N. and adds, "hurricane centre passing south of us." Very low pressures continued over a small area in mid-ocean until the 13th, on which day S. S. Indiana reported barometer 29.26 in 48° N., 30° W. No. VI appears to have sprung up in rear of No. III on on the 11th or 12th. On the latter date comparatively low pressures were experienced over a large area including the Bahamas, (Grand Turk 29.70,) the West Indies (Navassa, 29.91 and St. Thomas 29.82) and the Bermudas (Gibb's Hill Light, about 29.77.) At St. Thomas heavy rain fell from 2 to 3 p. m. Bark *America* reports on the 12th, in 27° N., 66° W., revolving gale from W. at 9 a. m., wind SE., barometer 29.10; 13th, 3 p, m., 29° N., 67° W., wind shifted to NNE., blowing heavily, barometer 29.05 and at 6 p. m. 29.20. Bark *Pepita* reports: 12th, 26° N., 66° W., W'ly gale set in, barometer falling slowly to 29.10; 13th, noon, 28° N., 67° W., wind hauled to southward with increasing gale; 4 p. m., barometer 28.65; 5 p. m., NE., steady gale, "bark enveloped in thunder and lightning;" 6 p. m., hurricane, vessel hove to under bare poles and thrown on beamends; 8 p. m., wind shifted back to E'd; 9 p. m., barometer rising; 10 p. m., heavy seas sweeping deck; midnight, gale moderating, but heavy seas breaking in all directions. Capt. Robt. Yaxley, of the steamer *Nasmyth* forwards a very valuable record of this storm, from which the following items are taken:—12th, 25° N., 59° W., barometer 30.20, "the sky all round having a dull, green appearance;" 13th, noon, 27° N., 62° W., rain squalls, "the clouds having great way on them from the SSW., with low, rugged clouds near the horizon," barometer gradually falling from 30.00 at noon to 29.00 at midnight; 14th, 3.30 a. m., wind shifted to SE. in a very heavy squall, lasting about 20 minutes and then backed to SSW. again; 4 a. m., lowest barometer, 28.90; 5.30 a. m., "quite a lull for 20 minutes, the wind then came out from NW. with great strength and a high cross sea," which continued throughout the day, with rising barometer. The *Bermuda Gazette*, Oct. 19th, states "the steady barometer and lull on Wednesday, the 13th, (i. e. after the passage of storm No. III as above) was but the precursor of another storm, for on that night (13th–14th) the wind increased and the barometer fell." At Gibbs' Hill, by noon, 14th, the barometer had fallen to about 29.79, with N. gale and squalls. On the 15th the weather at Bermudas moderated and after quite a stormy period of 7 days duration fine weather generally prevailed at these Islands to the end of the month. No. VII advanced slowly southeastward over the Canadian Maritime Provinces and Newfoundland during the 13th and 14th, and from the 15th to the 18th existed as quite a large area of low barometer over the eastern half of the ocean between the parallels of 30 and 60 N. On the 18th, however, a new centre of depression appears to have formed, somewhat to the south of the preceding, the position of which is shown upon the chart as No. VIII. On the 15th, hurricane winds, from SSE. veering by E. to NW. and lasting 16 hours, were experienced by schooner *Annie J. Marshall*, in 45° N., 50° W. The following low barometer-readings are reported by steamship *Hibernian*, 15th, 48° N., 50° W., 29.11, SSE. 5; 16th, 49° N., 45° W., 29.05, SE. by E. 4. No. VIII moved slowly eastward as a large area of low pressure over the region of the Azores from the 18th to 21st, and arrived upon the coast of Europe on the latter day and the 22nd, as a very severe storm. On the 23rd it appears to have passed rapidly towards the southeast of Europe. During its passage over the eastern half of the Atlantic it was accompanied in its northern quadrants by very severe easterly gales, which were experienced by steamers *Celtic* in 48° N., 31° W., *Nederland* in 48° N., 27° W., and by the *Hermann* in 59° N., 4° W. It was preceded on the European coast by a very severe storm, which appears to have sprung up during the night of the 19th, off the mouth of the English Channel, and which passed rapidly eastward to central Europe during the 20th. No. IX moved northward along the American coast as a very severe storm during the 22nd and 23rd, and was described as No. VIII in the October REVIEW. Over the ocean hurricane winds were experienced on the 22nd and 23rd in 39° N., 74° W., in 40° N., 74° W., and in 42° N., 62° W., and severe gales eastward to the western edge of the Banks of Newfoundland. On the 25th low pressures and easterly high winds or gales prevailed over mid-ocean between 40° and 50° N., and during the 26th and 27th, area No. X appears to have moved rapidly eastward to the European coast, the centre of depression arriving over the British Isles on the 28th, and being followed over the ocean by high barometer, the pressure gradually increasing to the end of the month.

Chart No. V.—Upon this chart are shown the mean pressure, mean temperature, mean force and prevailing direction of the wind at 7:35 a. m., Washington mean time, (0:43 p. m., Greenwich mean time,) for *March*, 1879, over the Northern and at certain stations in the Southern Hemisphere. High pressures, (30.20 in. or 767.1 mm.,) prevailed over the interior of Asia, and the greatest part of the North Atlantic ocean, the highest pressures having been between parallels 30° and 40° north and meridians 25° and 40° west. Low pressures (29.80 in. or 756.9 mm.) extended from Baffin's Bay eastward covering Greenland, Iceland and the northern portions of Sweden, Norway and Russia in Europe, the region of the lowest pressure evidently being within the Arctic zone north of Iceland. The following low pressures prevailed in the vicinity of Behring's sea: 29.55 or 750.6 mm. at St. Paul's Island and 29.76 or 755.9 mm. at St. Michael's. The pressures in Hindostan were slightly above 29.80. The highest mean pressures reported were Ponta Delgada, 30.30 in. or 769.6 mm.; Yennisseisk, 30.28 or 769.1; the lowest, St. Paul's

Island, Behring's sea, 29.55 or 750.5; Stykkisholm, 29.60 or 751.8 The highest readings (reduced to sea level,) reported by coöperating observers were 30.77 or 781.5 at Eastport, Maine, on March 1st, Yennisseisk, 30.73 or 780.6 on the 6th; the lowest 28.57 or 725.7 at St. Paul's Island on the 29th; elsewhere the pressure of 31.00 or 787.4 has been noted as occurring at Irkutsk on the 17th. The lowest temperature mean is that of York Factory —14° F. or 25°.6 C. The winds in general may be said to have been *northwesterly*. In North America they were *variable* except *northwesterly* in the United States eastward of the Mississippi valley; over the North Atlantic ocean, north of parallel 40° *northwesterly* except along the European coast where they were *southwesterly;* in Europe *westerly* with a southern tendency northward of parallel 50° and a northern tendency to the southward of it; in Algeria *variable*, in Asia *northwesterly* in Hindostan and *northerly* along the western coast; being elsewhere on that continent *variable*. As compared with the similar chart for the preceding month (February, 1879,) the following changes are noted: A general increase of pressure over Europe, (except southern Spain and Portugal,) the Atlantic ocean, north of parallel 40° and over the extreme eastern portion of North America. This increase was most marked over the British Isles, France and Germany; the greatest change noted Greenwich +0.54. Over Asia a general decrease of pressure occurred, amounting generally to 0.10. In but one instance, (Tashkend, 0.27,) was the decrease greater than 0.17 over that continent. Over the United States the pressure remained nearly stationary, but northwestward of that country the following *decreases* of pressure are noted: York Factory 0.24; St. Paul's Island 0.30 and St. Michaels 0.49. The greatest increase of temperature occurred over the continent of Asia where it probably averaged 10° F., the greatest change, +26° F. having occurred at Yennisseisk. A considerable increase of temperature also occurred in Sweden, Norway and in the interior of North America. But few and isolated stations report a slight and unimportant decrease of temperature.

Chart No. VI.—Upon this chart are traced the paths of 37 of the principal storm areas of the Northern Hemisphere during the month of *March*, 1879. Of these 9 are located along the eastern coast of Asia, and 5 over the Behring's Sea region. Of those along the Asiatic coast, five, Nos. XIV, XVI, XVII, XXXII, and XXXVII, appear to have come from the interior, while four, Nos. IV, XIII, XXIII and XXIX, apparently moved in a northeasterly course at a short distance off the coast and which were probably of tropical origin. For areas, Nos. IV, XVII, XXIII and XXXII, data, showing the progress of translation, similar to that given for areas XXII and XXVI of February, 1879, might be here produced, but for want of space are omitted. Of the storm areas over the North American continent, the unusually large number of 9 can be traced backwards to the Pacific, while of those leaving the eastern coast eight can be traced to the vicinity of Iceland or the European coast. Of those apparently originating over the Atlantic ocean, one, No. VIII, seems to have been of tropical origin, while Nos. II, VII and XXXI appear to have formed within a short distance of the European coast. Of the areas traversing Europe, four came from the Atlantic, and two, Nos. XIV and XIX, formed over the North Sea. The positions given for area No. II are, of course, somewhat doubtful, but the indications of the passage of this area throughout the whole extent from the Madeiras to the interior of Asia, are pretty well marked. The same may be said of the passage of area No. XVI across northern Asia, and of the path, shown in the small sectional chart in the lower right-hand corner, of the Mauritius cyclone of the 20th and 21st of March, 1879.

TEMPERATURE OF THE AIR.

The mean temperature of the air for November, 1880, is indicated by isotherms on chart No. II. The table of temperatures on the right-hand side of that chart shows, (as deduced from Signal Service observations of the past nine years,) the mean temperatures for the various districts, and the departures from such means during November, 1880. As will be observed from that table, the mean *in every district* of the country has been *below the normal*. Such deviations from the normal exceeded 5° over the entire country, except California, the Atlantic and East Gulf States and the Lake Ontario region. The following are the most notable departures at various stations: St. Louis, Indianapolis, Indianola, Corsicana, Brownsville and Denison, from 10.°2 to 11.°0; San Antonio, North Platte, Concho and Laredo, from 11.°5 to 12.°1; Fort Gibson, 12.°6; Cheyenne, 13°; Rio Grande City and Fort Griffin, Tex., 13.°1; Fort Davis, Tex., and Dodge City, 13.°7, and Denver, 16.°3. Except in the Atlantic States and the Lake Ontario region, (where either November 1873 or 1875 was slightly colder,) the present month has been the coldest since the establishment of the Signal Service stations. From detached stations, not included in districts, the following departures from the mean are noted: Mount Washington, 2.°3 below; Pike's Peak, 11.°2; Key West, 3.°6 below; Punta Rassa, 5.°4 *above*. In connection with the extremely low temperature of the month, and the deficiency of temperature in northern Florida and at Key West, it is particularly noticeable that the mean temperature at Punta Rassa should be the highest of any year since its establishment in 1871, November, 1873, only excepted.

The following extracts from reports of voluntary observers are noted as of interest:—*Illinois:* Morrison, average temperature lower than for many years; month remarkably cold. Riley, mean temperature 9°.3 below mean of 19 years, and 2°.2 below the coldest November. *Indiana:* Laconia, coldest November on record, or as compared with the past 17 years. St. Meinrad, 22nd, very cold, highest barometer for years. Vevay, coldest November ever observed at this station.

Iowa: Clinton, navigation closed on the Mississippi river same date as in 1872, but earlier than any other date recorded. Muscatine, 16th, Mississippi river closed by ice, earliest date ever recorded at this point. Boonsboro, month unusually cold; 15th, men, and 18th, teams crossed Des Moines river on the ice. Ft. Madison, month unusually cold. Glenwood, very cold. Monticello, Maquoketa river frozen over 20 days earlier than last year. *Kansas:* Lawrence, lowest mean temperature for Nov. for past 13 years. *Maine:* Gardiner, coldest November in 44 years, except in 1873; mean temperature for 44 years, 35.6. *Massachusetts:* Westborough, coldest November in several years; large quantities of apples frozen on the trees. Fall River, month unusually cold; 27th, ice 4 inches thick on Watuppa Lake. Springfield, month very cold. *Michigan:* Thornville, month very cold; 30th, ice 12 inches thick, apple and root crops severely damaged by freezing. Lansing, month very cold. Northport, month unusually cold *Missouri:* Frankford, month unusually cold. Oregon, mean temperature 11°.4 below that of the past twenty-six years. St. Louis, *Missouri Weather Service* reports "coldest November ever observed in this city. Previous to November, 1880, the lowest November mean temperatures were reported by Engelmann as follows: 1838, 34°.7; 1872, 36°.1; 1858, 37°.6; 1842, 37°.7; twelve times since 1837 the mean November temperature has fallen below 40°.0, while in 1849 the mean rose to 51°.8. The average November temperature is 42°.9. In 1845, the lowest minimum, —0°.5, was observed by Engelmann. In southwestern Missouri the daily temperature and mean temperature have been lower than ever observed at St. Louis. The coldest temperature in the State is reported from Neosho, —16° on the 18th and —4°.0 and —6°.0 on 17th and 19th." *New York:* Palermo, coldest November in 27 years, except in 1873, when mean temperature was 2°.0 lower. North Volney, mean temperature for November for past 10 years 35°.2; November, 1880, 31°.3 or 3°.9 lower. Coldest November was in 1873, 29°.8, lowest minimum —7°.0 in 1875; November, 1880, shows the largest monthly range of temperature, 69° ever recorded at this station. Waterburg, mean temperature of November for past 6 years 32°.1; November, 1880, 30°.8 or 1°.3 lower. Schroon Lake, month very cold; Schroon Lake frozen over on the 28th. *Nebraska:* Austin, 30th, Middle Loup river frozen over and teams crossing. Clear Creek, very cold month; 16th, Platte river closed with ice; 19th, teams crossing; 30th, heavily loaded wagons still crossing on the ice. *Ohio:* North Lewisburg, mean temperature of November for past 49 years 39.7°; November, 1880, 29°.8 or 9°.9 lower; coldest year, 1874, 29°.8; warmest, November, 1849, 49°1. Wooster, month remarkable for its very low mean temperature, 29°.7. College Hill, coldest November ever experienced. *Pennsylvania:* Dyberry, coldest November in 25 years, except in 1873, when the mean monthly temperature was 26°.8 or 4°.0 lower than 1880. Milton, month very cold. Chambersburg, coldest November ever experienced here, thickest ice (6 inches) ever cut here so early in the season. Wellsboro, coldest November since 1854, ice from 10 to 14 inches in thickness, ground frozen to depth of 12 inches on the average. Catawissa, month very cold, freezing temperatures for 23 days. *Texas:* Austin, mean temperature of November 10°0 lower than for past 25 years. Cleburne, month very cold, 13 days of frost. *Virginia:* Dover Mines, mean temperature of month 4°.8 lower than in 1879, Wytheville, mean temperature of month 3°.0 below mean of 16 years, coldest November in 16 years. except in 1872, when the mean was 6°.0 lower, in 1873, 2°.0 lower and in 1879, 8°.0 lower. *West Virginia:* Flemington, month unusually cold. Helvetia, month very cold. *Wisconsin* Embarrass, coldest November ever observed at this station. Madison, coldest since 1875. Bloomfield, month very cold, 23rd, Geneva Lake frozen over. Ripon, month unusually cold.

Maximum and Minimum Temperatures.—In general the maximum temperatures for November, 1880, have ranged from 60° to 80°. The isotherm of 70° runs from Delaware southwestward to northern Texas, thence westward to California, where it turns northward so as to leave the whole of that State to the southwestward. Maximum temperatures under 60° were reported from the northerly stations in Maine, the Lake region and the Northwest, the lowest being 44° at Duluth and 49° at St. Vincent. Temperatures above 80° were reported from Florida, southern Texas and Arizona. The highest were as follows:—Yuma, 86°; Edinburg, 87°; Key West, 89°; Rio Grand City and Burkes, 90°. These temperatures have been unusually low over the entire country. Except in Florida and at the isolated stations of New Orleans, San Deigo and San Francisco, minimum temperatures below the freezing point have occurred during the month. A careful examination of minimum temperatures for November, in years past, shows that eastward of the 100th meridian, save at a few scattered stations, the lowest November minima, north of latitude 37° 50′, occurred in 1875, and south of that parallel, in 1877. In the Middle and Southern Plateau and Rocky Mountain districts, the greater part of the Western Gulf States, the Ohio valley and Tennessee, the temperatures have been lower than ever recorded in any preceding November. The following in comparison with other remarkable minima, are noted:—*Arizona:* Yuma, 22°; in 1850, 34°. *Indiana:* Spiceland, —14°; in 1874, —10°. *Indian Territory:* Ft. Sill, —4°; in 1873, 8°. *Kentucky:* Louisville, 8°; in 1874, 10°. *Michigan:* Lansing, —3°; in 1875, 3°. *Missouri:* St. Louis, 8°; in 1835, —1°. *Mississippi:* Vicksburg, 23°, in 1877, 23°. *Nebraska:* De Soto, —5°; in 1875, —1°. *Nevada:* Ft. McDermitt, 6°; in 1868, 5°. *New Mexico:* Ft. Union,—15°; in 1855, 5°; Santa Fé, —11°; in 1850, 3°. *Ohio:* Bethel, —10°; in 1874, —2°; Westerville, —13°; in 1874, 8°. *Tennessee:* Nashville, 15°; in 1877, 17°. *Texas:* San Antonio, 21°; in 1877, 22°; Brownsville, 30°; in 1873, 31°. *Utah:* Salt Lake City, 3°; in 1864, 22°. *Wyoming:* Ft. Bridger, —40°; in 1873, —27°. *Wisconsin:* Embarrass, —15°;

in 1877, —20°. *Colorado:* Denver —14°; in 1877, —18°; Ft. Garland, —30°; in 1873, —35°. These unusual temperatures occurring generally from 8 to 10 days earlier than the very low temperatures of 1873 and 1877, and covering, as they do, the greater part of the entire country, make this month, as regards its thermal conditions, the most extraordinary November on record.

The following are the maximum and minimum temperatures reported in each State and Territory:

Maximum Temperatures.—Alabama: 76° at Montgomery. *Arizona:* 86° at Yuma. *Arkansas:* 69° at Little Rock. *California:* 89° at *Princeton and 85° at Los Angeles. *Colorado:* 61° at Denver and 26° at Pike's Peak. *Connecticut:* 68° at *Mystic and 66° at New Haven and New London. *Dakota:* 66° at *Morriston and 63° at Bismarck. *Delaware:* 70° at Delaware Breakwater. *District of Columbia:* 70° at Washington. *Florida:* 39° at Jacksonville. *Georgia:* 77° at Savannah and *Quitman. *Iowa:* 68° at *Glenwood and 64° at Davenport. *Idaho:* 60° at Boise City. *Illinois:* 70° at *Louisville and 65° at Chicago. *Indiana:* 68° at *Logansport and *Vevay, and 63° at Indianapolis. *Indian Territory:* 69° at Ft. Sill. *Kansas:* 70° at Dodge City. *Kentucky:* 69° at Louisville. *Louisiana:* 78° at *Lake Charles, and 75° at New Orleans. *Maine:* 64° at *Orono and 59° at Portland. *Maryland:* 72° at *Emmittsburg and 69° at Baltimore. *Massachusetts:* 67° at *Fall River and 64° at Boston. *Michigan:* 67° at *Lansing and 59° at Detroit. *Minnesota:* 58° at St. Paul. *Mississippi:* 75° at Vicksburg. *Missouri:* 68° at St. Louis. *Montana:* 54° at Helena. *Nebraska:* 72 at *Austin and 66° at North Platte. *Nevada:* 63° at Winnemucca. *New Hampshire:* 60° at *Contoocookville and 49° on summit of Mt. Washington. *New Jersey:* 68° at Atlantic City. *New Mexico:* 80° at Socorro. *New York:* 67° at New York City. *North Carolina:* 77° at Wilmington. *Ohio:* 68° at Cincinnati. *Oregon:* 68° at Umatilla. *Pennsylvania:* 70° at Pittsburg. *Rhode Island:* 64° at Newport. *South Carolina:* 76° at *Aiken and 74° at Charleston. *Tennessee:* 73° at Knoxville. *Texas:* 89° at Rio Grande City and 82° at Jacksboro. *Utah:* 58° at Salt Lake City. *Vermont:* 66° at *Windsor and 64° at Burlington. *Virginia:* 75° at *Johnsontown and 72° at Norfolk. *Washington Territory:* 58° at Olympia. *West Virginia:* 72° at Morgantown. *Wisconsin:* 62° at Beloit and 60° at Madison and La Crosse. *Wyoming:* 54° at Cheyenne.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Minimum Temperatures.—Alabama: 22° at *Green Springs and 26° at Montgomery. *Arizona:* —1° at Prescott. *Arkansas:* —6° at *Mt. Ida and 10° at Little Rock. *California:* 17° at Campo and 26° at Red Bluff and Visalia. *Colorado:* —30° at *Ft. Garland, —14° at Denver, Signal Service, and —24° Voluntary observer, and —36° at Pike's Peak. *Connecticut:* 8° at *Mystic and *Southington and 13° at New Haven and New London. *Dakota:* —28° at Ft. Stevenson and —16° at Deadwood. *Delaware:* 16° at *Dover and 23° at Del. Breakwater. *District of Columbia:* 12.5° at Washington. *Florida:* 89° at Key West and 62° at Pensacola. *Georgia:* 24° at *Gainesville and and 25° at Atlanta. *Idaho:* 7° at Boise City. *Iowa:* —12° at *Cresco and —5° at Dubuque. *Illinois:* —11° at *Louisville and —3° at Champaign. *Indiana:* —14° at *Spiceland and *Logansport and —5° at Indianapolis. *Indian Territory:* —10° at Ft. Gibson. *Kansas:* —10° at *Yates Centre and —7° at Dodge City. *Kentucky:* 6° at *Bowling Green and 8° at Louisville. *Louisiana:* 18° at Shreveport. *Maine:* —9° at *Cornish and 9° at Eastport. *Maryland:* 7° at *Emmittsburg and 15° at Baltimore. *Massachusetts:* —3° at *Rowe and 9° at Thatcher's Island. *Michigan:* —10° at *Marshall and —9° at Escanaba. *Minnesota:* —22° at St. Vincent. *Mississippi:* 23° at Vicksburg. *Missouri:* —16° at *Neosho and 8° at St. Louis. *Montana:* —17° at Helena. *Nebraska:* —10° at *Ft. Hartsuff and —7° at North Platte. *Nevada:* —9° at Winnemucca. *New Hampshire:* —16° on summit of Mt. Washington and at *Grafton. *New Jersey:* 4° at Somerville and 12° at Atlantic City. *New Mexico:* —11° at Santa Fe. *New York:* —10° at *Schroon Lake and 3° at Buffalo. *North Carolina:* 10° at *Ellsworth and 18° at Charlotte. *Ohio:* —13° at *Westerville and —5° at Columbus. *Oregon:* 9° at Umatilla. *Pennsylvania:* —8° at *Franklin and 4° at Pittsburg. *Rhode Island:* 15° at Newport. *South Carolina:* 23° at *Aiken and 30° at Charleston. *Tennessee:* 12° at *Ashwood and 15° at Nashville. *Texas:* —1° at Pilot Point and —5° at Ft. Elliott. *Utah:* 3° at Salt Lake City. *Vermont:* —16° at *Woodstock and 4° at Burlington. *Virginia:* 9° at Mt. *Solon and *Snowville and 13° at Lynchburg. *Washington Territory:* 23° at *Olympia. *West Virginia:* 2° at *Flemington and 8° at Morgantown. *Wisconsin:* —26° at *Neillsville and —10° at La Crosse. *Wyoming:* —40° at Ft. Bridger and —16° at Cheyenne.

Those marked with a star (*) are reported by U. S. Army Post Surgeons or Voluntary Observers.

Ranges of Temperature at Signal Service Stations.—The *monthly ranges* will appear from the *maxima* and *minima* just given. The greatest *daily ranges* vary in the Upper Mississippi, Lower Missouri and Ohio valleys, Tennessee, the Lake region, the Atlantic and Eastern Gulf States, (except Florida) from 22° to 30°, except Portland, Me., 19°; Eastport, 21°; Milwaukee and St. Paul, 31°; La Crosse, 32°; Marquette, 35° and Knoxville, 38°. In the Western Gulf States these ranges increase from 24° at New Orleans, 25° at Galveston and 31° at Brownsville on the coast to 37° at Ft. Gibson, 42° at Concho and Uvalde in the interior. On the Pacific coast notable ranges are follows: San Francisco, 20°; San Diego and Umatilla, 25°; Campo, 48°. In the Southern Plateau they vary generally from 39° to 43°, but 52° is noted at El Paso. Other noteworthy ranges are Salt Lake City and Helena, 25°; Cheyenne, 32°; Denver and North Platte, 44°; Bismarck, 45°; Winnemucca, 50° and Ft. Bennett, 52°

Frosts were of almost daily occurrence in the Rocky Mountain and Plateau districts (except southern Arizona,) the Northwest and in the Lake region from November 2nd, and in the Atlantic and interior of the Gulf States, the Ohio valley and Tennessee from the 15th and 16th. On the Pacific coast they were frequent in the interior from the 19th. From the 16th killing frosts were frequent and general in the South Atlantic and Gulf States, extending to the entire coasts of Texas, Louisiana, Mississippi, Alabama and northern Florida. In California, frosts occurred at Yuma, Sacramento and Visalia on the 18th.

Ice.—The dates on which ice formed in the various districts are indicated in the preceding paragraph, where the days on which freezing temperatures occurred are given.

PRECIPITATION.

The general distribution of rain-fall (including melted snow,) for November 1880, is shown on Chart No. III, as accurately as possible from about 500 reports. The table on this chart shows for the various districts the *average* precipitation for November, as compared with that of the present month. The belt of greatest rain-fall extended from the Mountain region of North Carolina, southwestward to eastern Texas. Southern Arizona is the only section of country over which no rain has fallen during the month. The rain-fall in New England and the Middle Atlantic States continues deficient. In the first district the deficiencies since January 1, 1880 amount to 6.51 inches, in the latter to 4.60. A marked excess has been reported from Tennessee, the South Atlantic and Gulf States, amounting in the Western Gulf district to 3.38 inches, the greatest excess of the month. The departures from the average precipitation at certain stations in the last named district were as follows: Corsicana, 2.05 above; Shreveport, 2.89 above; Galveston, 3.30 above and Vicksburg, 9.52 above; the rain-fall at the last station was over three times the normal amount. On the Pacific coast the rain-fall has been generally deficient, being only about one-third of the average. In districts not named the deviations from the normal rain-fall have been less important.

Special Heavy Rains.—4th, Vicksburg, 1.15 inches in 3 hours and 25 minutes. 5th, Fredericksburg, Tex., 2.13 in. in less than 8 hours; Galveston, 2.04 in. 5th and 6th, Quitman, Ga., 4.70 in.; Emmittsburg, Md., 2.60 in.; Point Pleasant, La., 3.31 in. 6th, Cincinnati, 1.50 in.; Little Mountain, O., 1.50 in. in 15 hours; 7th, Niles, Mich., 1.40 in. in 7 hours. 9th, Memphis, 1.70 in. in 5 hours; Pt. Pleasant, La., 3.48 in.; Dodge City, 1.05 in. in 6 hours; Shreveport, 2.20 in. in 4 hours. 10th, Atlanta, 2.19 in.; Cedar Keys, Fla., 1.43 in. in 5 hours and 13 minutes; Pensacola, 1.23 in. in 3 hrs., 30 min. 13th, Galveston, 2.25 in., of which 1.91 fell in 8 hrs.; Indianola, 1.13 in. in 8 hrs.; Brownsville, Tex., 2.00 in. in less than 8 hrs.; Pensacola, 2.03 in. in 5 hrs. 20 min. 14th and 15th, Kittyhawk, 3.64 in., of which 2.15 in. fell in 16 hrs. 17th and 18th, Pt. Pleasant, La., 2.01 in. 20th, Block Island, 1.64 in. in 9 hrs. 30 min. 21st, Cedar Keys, Fla., 1.96 in. in 6 hrs. and 30 min. 24th and 25th, Pt. Pleasant, La., 3.01 in.; White Plains, N. Y., 2.20 in.; Vicksburg, 3.22 in., of which 2.97 fell in 16 hrs. 26th and 27th, Green Springs, Ala., 4.73 in. 27th and 28th, Gainesville, Ga., 4.00 in.; Pt. Pleasant, La., 4.07 in.; Vicksburg, 4.03 in., of which 2.89 fell in 16 hrs.; Fayette, Miss., 5.60 in. 28th, Chattanooga, 1.98 in. 28th and 29th, Highlands, N. C., 2.90 in; Franklin, N. C., 4.40 in. 29th and 30th, Green Springs, Ala., 3.50 in.; Pt. Pleasant, La., 2.61 in. 30th, Chattanooga, 1.93 in. in 8 hrs; Vicksburg, 2.81 in., of which 1.77 fell in 8 hrs.

The Largest Monthly Rain-falls during November 1880, are as follows:—Point Pleasant, La., 19.52 inches. Vicksburg, Miss., 14.15. Cape Hatteras, N. C., 12.86. Ellsworth, N. C., 13.50. Fayette, Miss, 10.60. Green Springs, Ala., 10.54. Kittyhawk, N. C., 9.92. Mt. Washington, N. H., 9.37. Quitman, Ga., 8.90. Galveston, Tex., 8.85. Chattanooga, Tenn., 8.82. Highlands, N. C., 8.73. New Ulm, Tex., 8.62. Gainesville, Ga., 8.40. Memphis, 8.39. Atlanta, Ga., 8.21. Cape Henry, Va., 8.11.

The Smallest Monthly Rain-falls are:—Arizona, (except 0.13 inch at Forts Apache and Verde,) none. Ft. Yuma, Cal., Silver City, N. M. and Ft. Pembina, Dak., none. Ft. Hall, Idaho, Battle Mountain, Nev., El Paso, Tex. and Suisan, Cal., 0.02. Olivet, D. T., 0.03. Morriston, D. T., Dunnigan, Delano, and Sacramento, Cal. and Kelkon, Utah, 0.05. Petaluma, Cal. and St. Vincent, 0.07. Ravenna, Cal., and Hermosa, Cal., 0.09. Ft. Elliott, Tex., Ft. Wallace, Kan., Reno, Beowawe and Golconda, Nev., Blue Creek, Utah, and Tehama, Willows and Tehachapi, Cal., 0.10. Nora Springs, Iowa, 0.12. La Mesilla, N. M., Reading, Cal., 0.13. Red Bluff and South Vallejo, Cal., 0.14.

Rainy Days.—The number of days on which rain or snow has fallen, varies as follows: New England, 9 to 21. Middle Atlantic States, 7 to 18. South Atlantic States, 13 to 21. Eastern Gulf States, 7 to 18. Western Gulf States, 11 to 22. Ohio valley and Tennessee, 13 to 17. Lower Lake region, 17 to 24. Upper Lake region, 12 to 18. Upper Mississippi valley, 9 to 14. Lower Missouri valley, 6 to 15. Valley of the Red River of the North, 9 to 14. Texas, 2 to 17. Rocky Mountains, 0 to 14. Middle Plateau, 1 to 13. California, 1 to 3. Oregon, 4 to 11.

Cloudy Days.—The number varies in New England from 3 to 18. Middle Atlantic States, 5 to 15. South Atlantic States, 14 to 20. Eastern Gulf States, 2 to 18. Western Gulf States, 13 to 19. Ohio valley and Tennessee, 10 to 17. Lower Lake region, 13 to 20. Upper Lake region, 10 to 19. Upper Mississippi valley, 9 to 14. Missouri valley, 9 to 12. Valley of the Red River of the North, 6 to 9. Texas, 10 to 19. Rocky Mountains, 3 to 9. Middle Plateau, 3 to 9. California, 1 to 4. Oregon, 9 to 12.

Droughts.—Wellington, Kan., 30th, streams and springs drying up. Mendon, Mass., 30th, many wells dry. Westborough, Mass., 30th, brooks, springs and wells very low. Antrim, N. H., streams unusually low.

Snow from Cloudless Sky.—Lawrence, Kan., 27th. New Ulm, Minn., 28th. Santa Fe, 5th.

RELATIVE HUMIDITY.

The percentage of mean relative humidity for the month ranges as follows: New England, 63 to 75. Middle Atlantic States, 66 to 90. South Atlantic States, 65 to 83. Eastern Gulf States, 69 to 83. Western Gulf States, 64 to 82. Ohio valley and Tennessee, 64 to 80. Lower Lake region, 69 to 75. Upper Lake region, 66 to 86. Upper Mississippi valley, 63 to 71. Lower Missouri valley, 60 to 79. Red River of the North Valley, 78 to 85. Texas, 66 to 82. Middle Plateau, 36 to 59. California, 43 to 59. Oregon, 74 to 83. *High stations* report the following percentages not corrected for altitude: Mt. Washington, 88.6; Pike's Peak, 60.6; Santa Fe, 55.2; Cheyenne, 56.1; Denver, 64.3.

WINDS.

The prevailing winds at Signal Service stations are shown on chart No. II, by arrows which fly with the wind. *Westerly* winds have prevailed in the Lake region and New England; *northwesterly* winds in the Middle States; *northeasterly* in the South Atlantic and East Gulf States; elsewhere east of the Rocky Mountains they have been *northerly*, except in the Upper Mississippi valley, where they were from *northwest* to *southwest*.

High Winds.—On Mount Washington a velocity of 105 miles, NW., occurred on the 21st, and 102, NW., on the 7th and 12th. Maximum velocities ranging from 52 to 96 miles, occurred on eighteen other days; these high winds were from the northwest on all but five days, four from the south and one from the southwest. Maximum velocities exceeding fifty miles or more occurred elsewhere as follows: Kittyhawk, N. 50, on the 23rd; Cape Lookout, E. 50, on the 4th; Buffalo, SW. 52 on the 7th; Cape May, NW. 60 on the 21st; Pike's Peak, W. 70, on the 20th.

The following are the largest total movements in the various districts: Pike's Peak, 15,645. Cape Lookout, 12,763. Wood's Holl, 12,316. Indianola, 12,109. Cape May, 11,667. New Shoreham, 11,602. Mount Washington, 10,087, incomplete on account of frost-work. Sandusky, 8,976. North Platte, 8,827. Alpena, 8,202. Breckenridge, 8,112. Bismarck, 8,085. Winnemucca, 6,040. The *smallest* are: Roseburg, 1,135. La Mesilla, 1,208. Visalia, 1,580. Lynchburg, 1,722. Augusta, 2,066. Salt Lake City, 2,090. Uvalde, 2,620. Helena, 2,838. Nashville, 2,893. Leavenworth, 3,031. Springfield, Mass., 3,068.

Local storms, worthy of record, have been noted in connection with the various high and low areas, except as follows: A violent tornado at Keachi, De Soto parish, La., at 4:30 p. m., November 9th. Its course was from north to south, in a path about two hundred and fifty yards wide; length from eight to ten miles. On Moore's plantation, four miles distant, a gin house was blown down, killing one man and four mules. The chapel and other buildings, connected with the Baptist Female college, at Keachi, were unroofed or badly damaged; seven other buildings were torn to pieces or much damaged. In Keachi, one person was killed and nine were injured, three seriously. Serious damage was done at other places in the parish to buildings and other property. On the 13th a a violent wind storm occurred in Santa Ana valley, Cal., prostrating all the wind mills and telegraph wires and delaying trains, several of which were ditched.

Whirlwind.—Yuma, Cal., 21st, traveling from southwest to northeast; cloud funnel-shaped, upper end lagged behind so as to incline the column about 70° from the perpendicular; cloud about ten feet in diameter and appeared to revolve from left to right.

Sand-Storms.—Visalia, Cal., 17th, 18th, very severe on the 19th, killing large numbers of sheep. Umatilla, Or., 7th, very severe. Near Mammoth Tank, Cal., 16th, worst ever known; stopped railway traffic for sixteen hours.

VERIFICATIONS.

Indications.—The detailed comparison of the tri-daily indications for November, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.2 per cent. The percentages for the four elements are: Weather, 89.6; Direction of the Wind, 82.6; Temperature, 87.2; Barometer, 81.0 per cent. By geographical districts they are: for New England, 82.7; Middle States, 80.4; South Atlantic States, 84.4; Eastern Gulf States, 86.6; Western Gulf States, 89.8; Lower Lake region, 86.2; Upper Lake region, 87.5; Tennessee and the Ohio valley, 86.6; Upper Mississippi valley, 84.2; Lower Missouri valley, 83.3; Northern Pacific coast region, 78.4; Central Pacific coast region, 88.0; Southern Pacific coast region, 91.7. There were 32 omissions to predict out of 3,690 or 0.87 per cent. Of the 3,658 predictions that have been made, 166, or 4.54 per cent. are considered to have entirely failed; 101, or 2.76 per cent. were one-fourth verified; 378, or 10.33 per cent. were one-half verified; 442, or 12.08 per cent. were three-fourths verified; 2,571, or 70.29 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

Cautionary Signals—218 Cautionary Signals were displayed during the month, of which 190, or 87.2 per cent., were justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of, the station. 68 Off-shore Signals were displayed, of which 60 or 91.2 per cent, were fully justified, and 64 or 94.1 per cent, justified as to direction. Forty-five of the Off-Shore were changed from Cautionary.

286 Signals of both kinds were displayed, of which 250 or 87.4 per cent, were fully justified. 56 cases of winds of 25 miles and over per hour, from scattered stations, were reported, for which signals had not been ordered. The above does not include signals ordered for 49 display stations, where the velocity is only estimated. Thirty-one signals were ordered late.

NAVIGATION.

Stage of Water in Rivers.—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as recorded on the Signal Service river gauges, during November, 1880. During the entire month the rivers throughout the country continued remarkably low, no freshet worthy of special note being recorded. The *Missouri* remained almost stationary throughout the month, the largest monthly range at any individual station being 17 inches at Omaha; on the 18th it commenced to freeze at Yankton. In all the other rivers there was a general tendency to rise during the 1st, (ending Nov. 6th,) and 2nd, (ending Nov. 13th,) weeks, and, except at stations in the lower Mississippi, a general fall during the 3rd and 4th weeks.

Ice in Rivers and Harbors.—Below is a summary of the data in reference to the formation of ice upon navigable streams, canals and in the harbors at Lake ports. Ice commenced forming in large quantities in the rivers of the Northwest about the middle of the month and in those over the eastern portions of the country from the 19th to the 22nd. The early closing of the canals of Pennsylvania and New York entailed large losses upon those interested therein. The following items are arranged geographically: *Missouri river.*—Fort Bennett, Dak., 17th, river frozen over, navigation closed; 18th, people crossing on the ice. Omaha, Neb., 14th to 30th floating ice; 16th, ferry boats stopped running. Leavenworth, the river full of ice from the 17th to the end of the month. *Platte River.*—North Platte, Neb., 5th, ice 3 inches thick. Clear Creek, Neb., 16th, river closed; 19th, teams crossing on ice; 30th, heavily loaded wagons "still crossing." *Middle Loup River.*—Austin, Sherman co., Neb., 30th, teams crossing on ice. *Red River of the North.*—St. Vincent, Minn., 11th, river freezing; 12th, navigation closed. *Mississippi.*—St. Paul, Minnesota, 13th to 16th, floating ice; navigation closed on the 16th; 17th, river frozen over. La Crosse, Wis., 14th and 16th, floating ice; 19th, river frozen over. Dubuque, Ia., 16th, floating ice, navigation closed, earliest date on record; 22nd, frozen over, men crossing; 23rd, teams crossing. Fulton, Ill., and Clinton, Ia., 15th, navigation closed—same date as in 1872,but earlier than any other recorded date—at Clinton, ice in river on 17th, gorged on 18th and 13 inches thick on the 30th. Davenport, Ia., 21st, river frozen along banks; 22nd, gorged and closed on earliest date on record; 25th, frozen over; 26th, people crossing; 28th, teams crossing. Muscatine, Ia., 16th, floating ice; 21st, river closed by ice, "earliest closing on record;" 29th, first team crossed—ice in channel 7 inches thick. Burlington, Ia., 16th, floating ice quite dangerous to navigation, last boat passed down, navigation closed; 18th to 21st, floating ice; 22nd, gorged; 23rd, frozen over, people crossing; 30th, teams crossing. Montrose, Iowa, 21st, river frozen over. Keokuk, Iowa, 17th, first ice in river, Illinois side closed; 18th, navigation closed, heavy floating ice; 19th, canal frozen over; 22nd to 30th, heavy floating ice. St. Louis, Mo., 18th, navigation suspended; 18th to 30th, floating ice. *Des Moines River.*—Boonsboro, Ia., 15th, river frozen, men crossing; 18th, teams crossing. Des Moines, 16th, river frozen over. Keokuk, Ia., 20th, Des Moines river frozen over near the mouth. *Kansas River.*—Lawrence, Kan., 18th, frozen over. *Neosho or Grand River.*—Fort Gibson, Ind. Ter., 18th, frozen over; 19th, ice 3 inches thick. *Rock River.*—Frozen over at Lyndon, Ills., on the 14th and at Rockford, Ill., on the 17th. *Ohio River.*—Pittsburg, Pa., 18th, 19th and 23d, ice in river; 22d, frozen over. *Monongahela River.*—Morgantown, W. Va., 22nd to 28th, frozen over; 29th, opening; 29th, Cheat river opening; 30th, ice in Monongahela breaking up; at two a. m. ice gorged for a distance of four miles. *Susquehanna River.*—*West Branch*—Milton, Pa.,24th, frozen over; *North Branch*—Catawissa, 26th, closed by ice. *Delaware River.*—Philadelphia, 23rd, floating ice. *Hudson River.*—Albany, 21st and 22nd, floating ice; 23rd frozen over; 21st, ice formed on canal; 22nd, navigation on canal suspended; 25th, navigation entirely closed; 24th, closed from Albany to Hudson. In a report on the closing of the Hudson, at Newburgh, N. Y., based on observations recorded by Hutchings and Mr. James H. Gardiner, and giving details for the years 1740, 1755, 1764, 1770, 1779, 1785, 1789 to 1831, 1834 to 1838 and 1850 to 1878, only five November dates appear, which are as follows:—November 28th, 1796; November 20th, 1797; November 23rd, 1798; November 13th, 1820 and November 29th, 1823. In a table, published in Hough's *New York Meteorology, 2nd series*, giving the dates of closing of the Hudson at Albany, and based upon observations for the years 1645, 1646 and 1790 to 1872, the following November dates, prior to the 25th, are found:—13th, 1820: 23rd, 1798 and 24th, 1645. In another table in the same work, giving the closing at Hudson from 1817 to 1870, inclusive, the following November dates only appear:—25th, 1838 and 30th, 1820. *Connecticut River.*—Springfield, Mass., 22nd, frozen over. New Haven, 24th, navigation on river closed; river full of floating ice; earliest date of closing of navigation during the past 48 years. *Watuppa Lake.*—Mass., 27th, ice 4 inches thick. *Penobscot River.*—Bangor, Me., 24th, ice quite thick; 27th, navigation closed on the earliest date for the past 38 years. At this port, it has occurred but twice previously in November since 1844, namely, on November 30th, 1871, and November 29th, 1875. *Kennebec River.*—Gardiner, Me., 23rd, river closed. From a record of the closing of this river for the past 94 years, it appears that earlier dates have only been recorded on 8 years, as follows: November 16th, in 1820 and

1823; 18th, in 1786; 19th, in 1804 and 1873; 20th, in 1806, and 22nd 1797 and 1875; in 6 previous years—1792, 1798, 1809, 1825, 1835 and 1855, it has closed on the same date, the 23rd. *Lake Superior.*—Duluth, 15th, ice forming rapidly; 24th, ice broken up by storm; 25th, commenced to go out and lodge along north shore; 28th end of lake full of ice; 29th, lake filled with thin ice as far as can be seen. Ashland, Wis., Long Island Bay closed by ice on the 16th. Marquette, Mich, 13th, navigation closed. *Geneva Lake.*—Bloomfield, Wis., 23rd, frozen over. *Wolf River.*—Near Embarrass, Wis., 23d, frozen over. *Lake Michigan.*—Escanaba, 25th, bay frozen over; 29th, navigation practically closed. The sudden and unexpected closing of navigation laid up 21 vessels at this port, 12 of which were loaded. Chicago, 21st, lake frozen; 26th, many vessels reported ice-bound at different ports along the lake; 30th, navigation generally closed. *Grand River.*—Lansing, Mich., 19th, closed by ice. Grand Haven, Mich., 21st, river closed by ice. *Lake Huron.*—Alpena, Mich., 22nd, Thunder Bay river frozen over; Thunder Bay full of ice as far as can be seen; 12 or 15 boats frozen in; 24th, steamer arrived from Detroit with great difficulty; 28th, bay partly clear. Port Huron, Mich., 20th, Black river frozen over solid, "the harbor crowded with vessels waiting an opportunity to break through St. Clair Flats which are reported frozen over"; 23rd, vessels going into winter quarters. *Detroit River.*—Detroit, 19th to 21st, ice in river; 22nd, navigation suspended; 26th, navigation resumed. *Lake Erie.*—Toledo, 17th, ice in river; 28th, frozen over, ice 2 inches thick; 22nd, 6 inches thick; 24th, navigation closed. Sandusky, Ohio, 19th, ice 2 inches thick formed over greater part of bay; steamers going into winter quarters; 20th, bay frozen entirely across; 27th, twenty-four large propellors, grain-laden, ice bound near Point au Pelee island. Erie, Pa., 22nd, bay frozen over. *Lake Ontario.*—Oswego, N. Y., 22nd, canal closed by ice. *Schroon Lake*, N. Y., 28th, frozen over. *Lake Champlain.*—Burlington, Vt., 24th, Winooski river and upper part of lake frozen over.

CANALS.—*Miami.*—Cincinnati, Ohio, 19th, closed; 22nd, frozen over; 27th, ice 5 inches thick. *Erie.*—Rochester, N. Y., 19th, canal and Genessee river frozen over; 22nd, navigation in canal closed—700 boats frozen in between Buffalo and Syracuse. *Pennsylvania—West branch*—Milton, Pa., 22nd, frozen over; *North branch*—Catawissa, Pa., 22nd, closed by ice. *Lehigh, Delaware and Morris*—Easton, Pa., 24th, frozen up—navigation entirely ceased—100 boats frozen up at Port Delaware; the Lehigh canal, from Easton to Mauch Chunk, lined with loaded canal boats fast in the ice—"such a cold spell at this season has not been known for a great many years." Dyberry, Pa., 22nd, canal navigation closed. *Delaware and Hudson River.*—Port Jervis, N. Y., 1st, navigation resumed after having been closed for want of water since September 22nd.

TEMPERATURE OF WATER.

The temperature of water, as observed in rivers and harbors at Signal Service Stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. II. Owing to the breaking of the thermometer, ice etc., observations are wanting, as follows: Alpena, from the 17th; Augusta, 11th to 15th; Chicago, from the 21st; Duluth, from the 28th; Detroit, from the 19th; Escanaba, from the 25th; Grand Haven, from the 21st; Marquette, 22nd, 29th and 30th; Mobile, from 1st to 23rd inclusive; Norfolk, from the 26th; Sandusky from the 21st; Toledo, from the 13th.

ATMOSPHERIC ELECTRICITY.

Thunder Storms have been comparatively rare, except in the Gulf States. Storms were reported from more than one station in that district on the 4th, 5th. 8th to 10th, 12th, 16th, 19th and 30th.

Zodiacal Light.—Indiana: New Corydon, 1st–3rd, 7th–9th, 12th. 14th, 15th, 21st–23rd, 25th–27th, 29th, 30th. *Iowa:* Monticello, 8th, 22nd, 29th. *Kansas:* Yates Centre, 21st, 22nd, 26th, 30th. Lawrence, looked for, none seen. *Minnesota:* St. Vincent, 14th and 30th. *Massachusetts:* Cambridge, (Harvard University,) 22nd, 23rd, 27th, 29th, 30th; Somerset, 29th. *Ohio:* Bellefontaine, 20th, 22nd, 23rd. *Missouri:* Oregon, 4th, 20th–22nd, 28th, 29th. *Nebraska:* Clear Creek, 26th, 28th.

Auroras.—On the 1st, the aurora was visible in Maine, Vermont and at Bismarck, Dak. On the 2nd and 3rd, it was observed generally in New England, New York and New Jersey. The most southerly station reporting it on the former date, was Somerville, N. J., and on the latter date, Moorestown, N. J. It was also observed, on the 2nd, at St. Vincent, Minn., and on the 3d, at Dayton, Wash. Ter. On the 21st, a display was observed at Newport, R. I., Wellsboro', Pa., and Lansing, Mich. On the 30th, a display was general in the northern part of New England; the most southerly station reporting, was Somerset, Mass.; it was noted the same day at Oswego, Port Huron and Breckenridge. Isolated displays are reported from New England under dates of the 4th, 6th to 10th, inclusive, from Pennsylvania on the 23rd and 26th, from Iowa on the 14th, 25th and 29th, Dakota on the 9th, from Minnesota on the 20th, 23rd. 27th and 29th, and from Nebraska on the 28th, from Indiana on the 20th, from Michigan on the 22nd. Lack of space forbids a description of these auroras, none of which appear from their descriptions, to have been unusually bright.

OPTICAL PHENOMENA

Solar Halos.—Guttenburg, Ia., 25th, 10 a. m., to 1 p. m., brilliant halo with five mock suns, two green and yellow and three white. Clinton, Ia., 17th, double halo in afternoon.

Lunar Halos.—Clinton, Ia., 17th, large double halo with two mock moons.

MISCELLANEOUS PHENOMENA.

Meteors.—Marinette, Wis., 3rd, 5 a. m., in northwest heavens; exploded, leaving luminous trail for 10 seconds.

Sunsets.—The characteristics of the sky at sunset as indicative of fair or foul weather for the succeeding twenty-four hours have been observed at all Signal Service Stations. Reports from 153 stations show 4,523 observations to have been made, of which 24 were reported doubtful; of the remainder, 3,690 or 81.6 per cent. were followed by the expected weather.

Earthquakes.—4th, San Jose, Cal., slight shock. San Francisco, 4th, severe shock at 7:37 p. m., vibration from east to west; duration 5 seconds; "no damage resulted, but things were generally shaken up." Los Angeles, 12th, 8:45 p. m., slight shock of earthquake; duration 3 seconds; no decided direction. Sharp shock at Santa Barbara, Cal., same date. at 10:30 p. m., NE. to SW., lasting several seconds; no damage reported. Los Angeles, Cal., 21st, three distinct shocks; first and heaviest at 7:45 p. m., was a tumbling, horizontal motion, from E. to W.; duration 30 seconds; second at 9:45 p. m.; third at 11 p. m., duration several seconds; no damage reported. Heavy shocks were felt at Wilmington, directly south, and at San Bernardino, east; 30th, Ashwood, Tenn., 2 p. m., heavy rumbling sound, supposed to be an earthquake.

Sun Spots.—The following record of observations, made by Mr. D. P. Todd, Assistant, has been forwarded by Prof. S. Newcomb, U. S. Navy, Superintendent Nautical Almanac Office, Washington, D. C.:

DATE—Nov., 1880.	No. of new—		Disappeared by solar rotation.		Reappeared by solar rotation.		Total number visible.		REMARKS.
	Groups	Spots.	Groups	Spots.	Groups	Spots.	Groups	Spots	
2nd, 4 p. m...	.....	.....	.....	.....	.....	.....	3	25†	
7th, 11 a. m...	0	0	.....	.....	0	0	1	3	Faculæ.
8th, 8 a. m...	0	0	0	0	0	0	1	3	Faculæ.
2 p. m...	0	0	0	0	0	0	1	3	Faculæ.
9th, 8 a. m...	1	5	1	3	0	0	1	5	Faculæ. Spots small.
11th, 11 a. m	0	0	0	0	0	0	0	0	Faculæ.
12th, 7 a. m ..	1	3	0	0	0	0	1	3	Faculæ.
15th, 8 a. m...	0	12	0	0	0	0	1	15	Faculæ.
16th, 8 a. m...	1	2	0	0	0	0	2	17	Faculæ.
19th, 8 a. m...	3	18	0	0	0	0	5	35	Faculæ.
20th, 4 p. m ..	0	0	1	7	0	0	4	28	
21st, 2 p. m...	0	0	0	8	0	0	4	30	Many of the spots small.
22nd, 9 a. m....	0	0	0	8	0	0	4	12	
23rd, 9 a. m....	1	4	1	6	1	6	4	12	Faculæ.
27th, 2 p. m...	2	16	3	6	2	16	3	22	
3 p. m....	0	0	0	0	0	0	3	22	
30th, 9 a. m...	0	0	0	0	0	0	2	20†	Faculæ.

†Approximated.

Mr. William Dawson, at Spiceland, Ind., reports: 1st, 3 groups, 21 spots, air very poor; 2nd, 4 groups, 35 spots, air good; 7th, no spots seen, air very poor; 8th, 1 group, 25 spots, air pretty good, faculæ at east and west; 9th, 3 groups, 6 spots, all small, air very poor; 12th, 1 group, 3 spots, air rather poor; 14th, 1 group, 15 spots, 6 minutes from east edge; 18th, 3 groups, 20 spots, 4 large spots in a row west of centre, air very bad; 19th, 3 groups, 29 spots; 20th, 2 groups, 26 spots, air very poor; 22nd, 3 groups, 12 spots, 2 groups very near west edge, 2 spots south of centre; 23rd, 3 groups, 7 spots, new group of 5 spots at east edge; 27th, 5 groups, 53 spots, 2 large spots very near together, 10 minutes from east edge, they were about 20,000 miles across and easily seen without telescope, air pretty good; 29th, 3 groups, 28 spots, 2 groups with large spots a little north of centre.

Mr. David Trowbridge, at Waterburgh, N. Y., reports: 2nd, 2 groups in south hemisphere, 3 spots; 9th, 10th, 11th, no spots; 16th, group in north hemisphere, half-way advanced across disk, one large spot; 17th, 3 groups, 1 in the north and 2 in the south hemisphere, 5 spots; 19th, 3 groups, same as 17th, 6 spots; 22nd, 2 groups very near west limb of sun; 23rd, the two groups have disappeared by solar rotation, no others visible; 25th, one group of 3 large spots in NE. quadrant; 26th, group of yesterday, 5 spots and a group $\frac{1}{3}$ of diameter from sun's west limb; 27th, large group, 5 spots and a faint group farther south and near the equator, faint group of yesterday disappeared; 29th, one large group, observations partly obscured by clouds; 30th, same group as yesterday, 1 large and 1 small spot. Observations on the 1st, 3rd to 7th, 12th to 15th, 18th, 20th, 21st, 24th and 28th, interrupted by clouds.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Chief Signal Officer.

Copy furnished for

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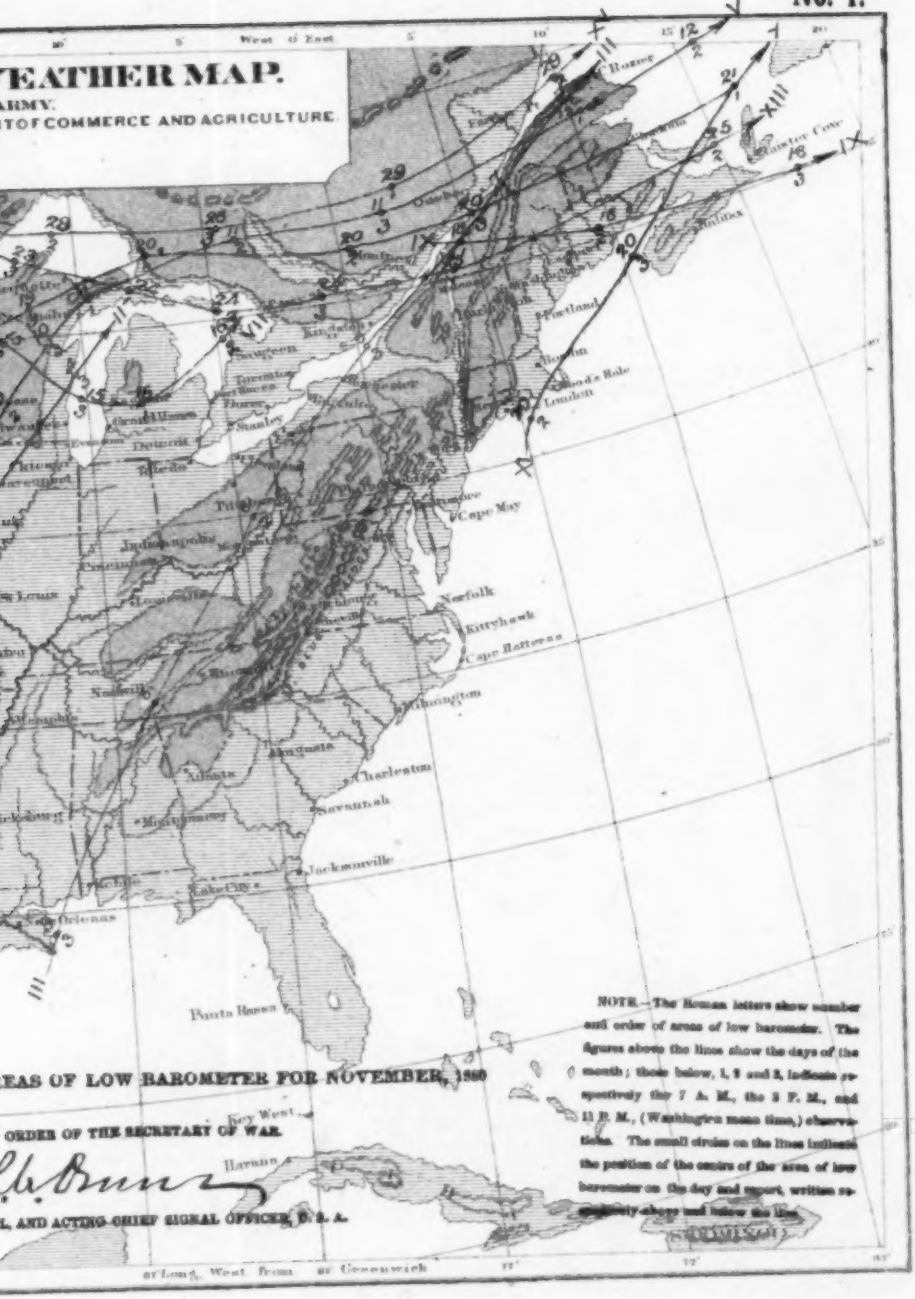
WAR DEPARTMENT WEA
SIGNAL SERVICE, U.S. ARMY.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT OF CO
San Francisco
San Diego
Virginia City
Ft Benton
Duluth
Ft Sully
St Paul
Omaha
Denver
Ft Leavenworth
St Louis
Cairo
Vicksburg
Shreveport
Galveston
Indianola
AVERAGE PROGRESS OF AREAS OF LOW BAROMETER EAST OF THE 105TH MERIDIAN:
No.
Velocity.
II. 25 miles per hour.
III. 45 do.
V. 25 do.
VII. 12 do.
IX. 40 do.
X. 20 do.
XI. 30 do.
XIII. 24 do.
XV. 30 do.
TRACKS OF CENTRES OF AREAS OF
PUBLISHED BY ORDER OF
ADJUTANT GENERAL, AND ACTI

No. I.


EATHER MAP.
ARMY.
T OF COMMERCE AND AGRICULTURE.
West of Greenwich
Portland
Boston
Cape May
Norfolk
Kittyhawk
Cape Hatteras
Wilmington
Charleston
Savannah
Jacksonville
Key West
Havana
Punta Roxa
NOTE.—The Roman letters show number and order of areas of low barometer. The figures above the lines show the days of the month; those below, 1, 2 and 3, indicate respectively the 7 A. M., the 3 P. M., and 11 P. M., (Washington mean time,) observations. The small circles on the lines indicate the position of the centre of the area of low barometer on the day and report, written respectively above and below the line.

EAS OF LOW BAROMETER FOR NOVEMBER, 1880

ORDER OF THE SECRETARY OF WAR.

L, AND ACTING CHIEF SIGNAL OFFICER, U. S. A.

WAR DEPARTMENT WE
SIGNAL SERVIC E. U S. ARM
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFIT O
ISOBARS, ISOTHERMS AND PREVAILING WINDS
TEMPERATURE OF WATER
NOVEMBER
STATIONS.
Temperature at bottom.
Max.
Min.
*Alpena
*Augusta
Baltimore
Buffalo
Burlington, Vt.
Cedar Keys
Charleston
*Chicago
Chincoteague
Cleveland
*Detroit
*Duluth
Del. Breakwater
Kesport
*Escanaba
Galveston
*Grand Haven
Jacksonville
Key West
*Marquette
Milwaukee
*Mobile
New London
New York
Norfolk
Portland, Maine
Punta Rassa
*Sandusky
San Francisco
Savannah
Smithville
*Toledo
Wilmington
Woods Holl
* Observations for only part of month—See text.
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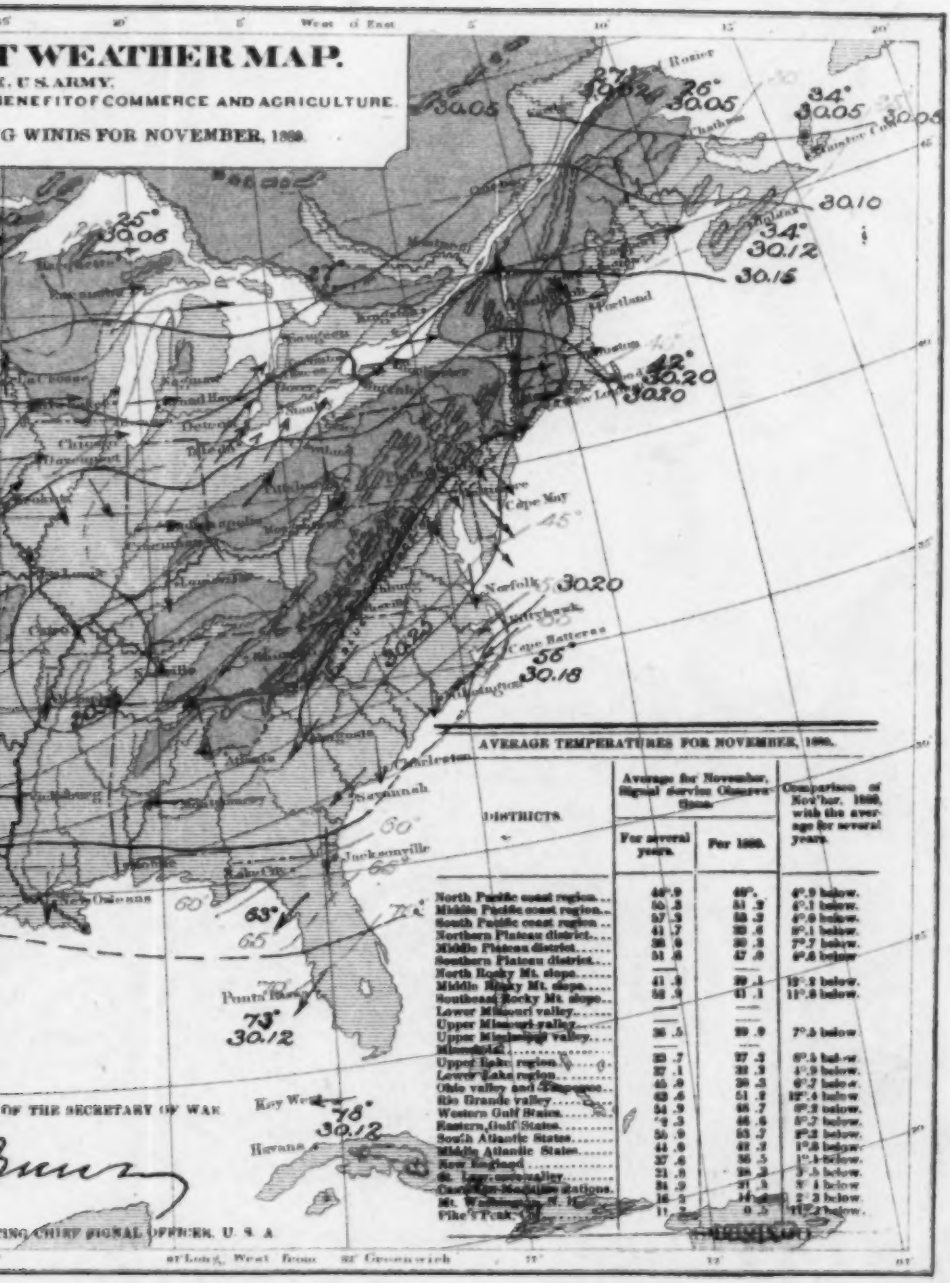
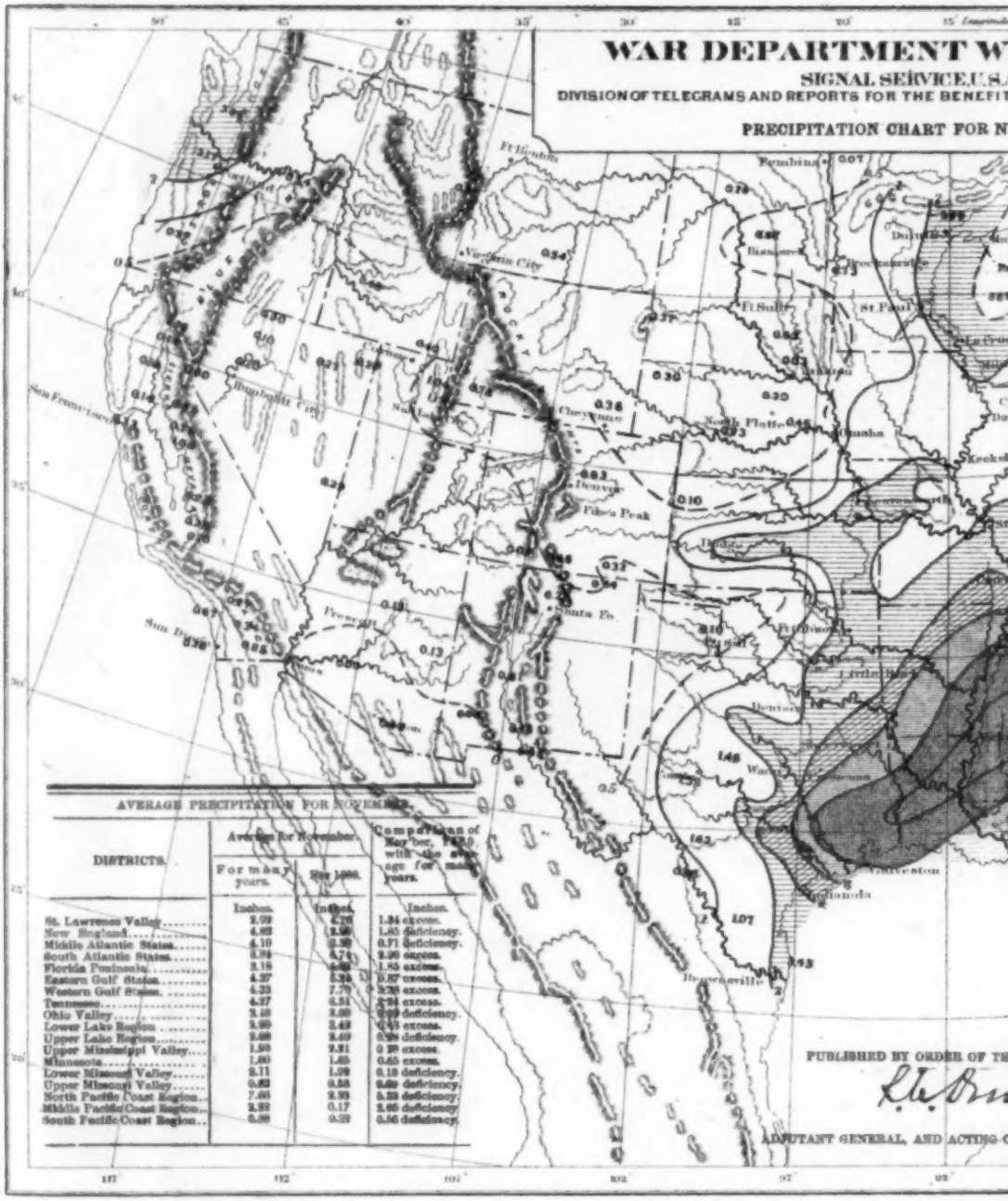
ASSISTANT GENERAL, AND ACTING CHIEF



AVERAGE TEMPERATURES FOR NOVEMBER, 1869.

DISTRICTS.	Average for November, Signal service Observations.		Comparison of Nov'ber, 1869, with the average for several years.
	For several years.	For 1869.	
North Pacific coast region	48°.9	49°.	4°.9 below.
Middle Pacific coast region	55.3	51 .2	6°.1 below.
South Pacific coast region	57.3	53 .3	4°.0 below.
Northern Plateau district	41 .7	32 .6	9°.1 below.
Middle Plateau district	38 .0	30 .3	7°.7 below.
Southern Plateau district	51 .6	47 .0	4°.6 below.
North Rocky Mt. slope	41 .3	30 .1	11°.2 below.
Middle Rocky Mt. slope	52 .2	41 .1	11°.0 below.
Southeast Rocky Mt. slope			
Lower Missouri valley			
Upper Missouri valley			
Upper Mississippi valley	36 .5	29 .0	7°.5 below.
Missouri			
Upper Lake region	29 .7	27 .3	6°.5 below.
Lower Lake region	37 .1	32 .3	4°.9 below.
Ohio valley and Tennessee	45 .0	38 .5	6°.7 below.
Rio Grande valley	63 .6	51 .2	12°.4 below.
Western Gulf States	54 .3	46 .7	6°.3 below.
Eastern Gulf States	49 .5	46 .6	2°.7 below.
South Atlantic States	55 .9	53 .7	2°.2 below.
Middle Atlantic States	44 .6	41 .3	1°.3 below.
New England	37 .6	36 .5	1°.1 below.
St. Lawrence valley	31 .8	28 .3	3°.5 below.
Canada-Nova Scotia Stations	34 .9	31 .5	3°.4 below.
Mt. Washington, N. H.	16 .2	14 .0	2°.2 below.
Pike's Peak, Col.	11 .2	0 .5	11°.7 below.


WAR DEPARTMENT W
SIGNAL SERVICE, U.S.
DIVISION OF TELEGRAMS AND REPORTS FOR THE BENEFI
PRECIPITATION CHART FOR N
PUBLISHED BY ORDER OF TH
ADJUTANT GENERAL, AND ACTING

AVERAGE PRECIPITATION FOR NOVEMBER.

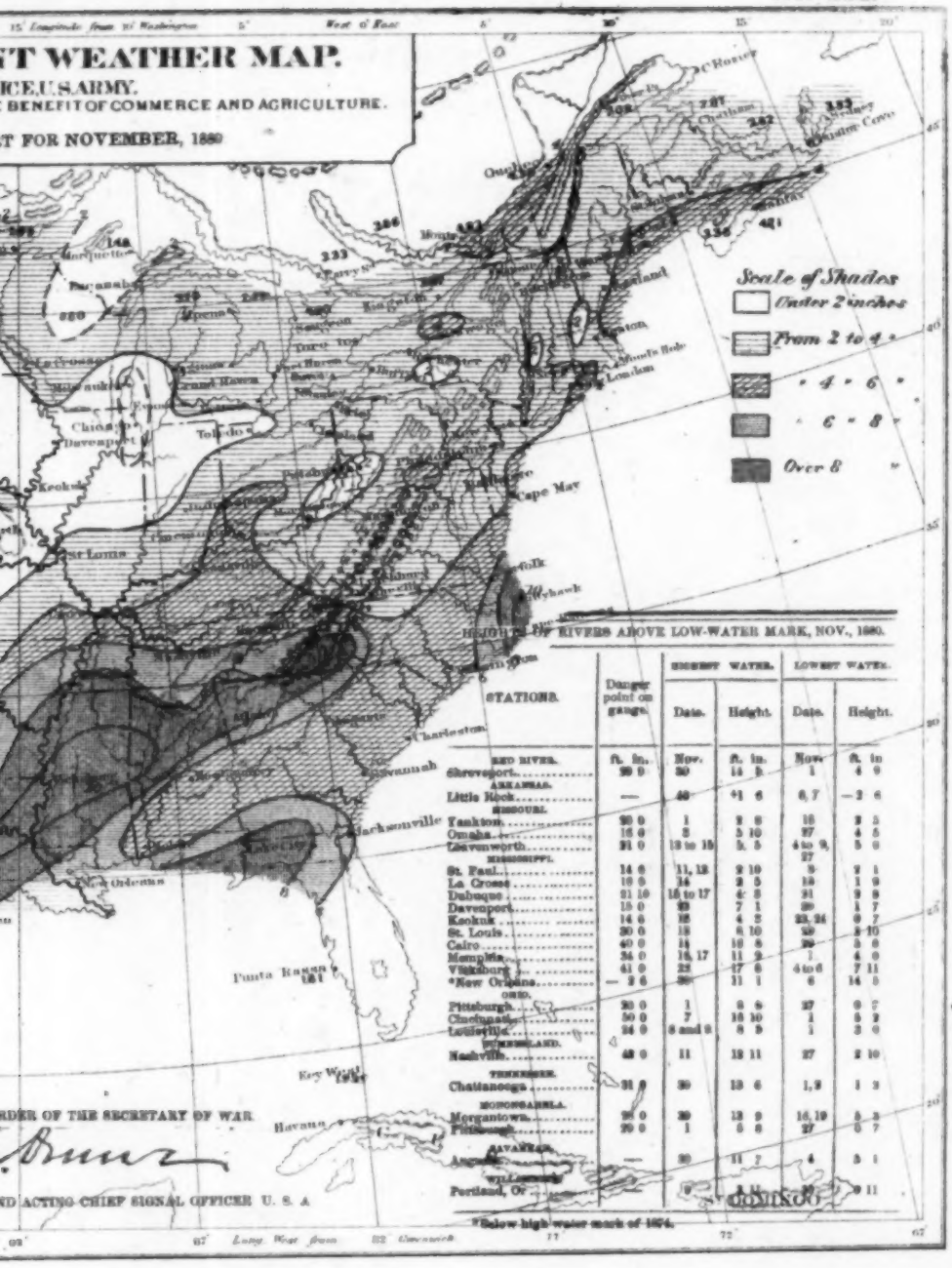
DISTRICTS.	Average for November: For many years.	Average for November: For 1880.	Comparison of November, 1880, with the average for many years.
	Inches.	Inches.	Inches.
St. Lawrence Valley	2.92	4.26	1.34 excess.
New England	4.83	3.00	1.83 deficiency.
Middle Atlantic States	4.10	3.39	0.71 deficiency.
South Atlantic States	3.94	4.74	0.80 excess.
Florida Peninsula	3.16	4.99	1.83 excess.
Eastern Gulf States	4.27	5.24	0.97 excess.
Western Gulf States	4.33	7.70	3.37 excess.
Tennessee	4.27	6.51	2.24 excess.
Ohio Valley	3.12	2.30	0.82 deficiency.
Lower Lake Region	3.96	5.49	1.53 excess.
Upper Lake Region	2.69	2.49	0.20 deficiency.
Upper Mississippi Valley	1.59	2.91	1.32 excess.
Minnesota	1.00	1.65	0.65 excess.
Lower Missouri Valley	0.11	1.29	0.18 deficiency.
Upper Missouri Valley	0.82	0.53	0.29 deficiency.
North Pacific Coast Region	7.66	2.33	5.33 deficiency.
Middle Pacific Coast Region	2.82	0.17	2.65 deficiency.
South Pacific Coast Region	0.39	0.39	0.00 deficiency.

T WEATHER MAP.

CE, U.S. ARMY.

E BENEFIT OF COMMERCE AND AGRICULTURE.

T FOR NOVEMBER, 1880



HIGHEST AND LOWEST RIVERS ABOVE LOW-WATER MARK, NOV., 1880.

STATIONS.	Danger point on gauge.	HIGHEST WATER. Date.	HIGHEST WATER. Height.	LOWEST WATER. Date.	LOWEST WATER. Height.
RED RIVER.	ft. in.	Nov.	ft. in.	Nov.	ft. in.
Shreveport	30 0	30	14 5	1	4 9
ARKANSAS.					
Little Rock	—	29	41 6	6, 7	—2 6
MISSOURI.					
Yankton	20 0	1	2 8	16	2 5
Omaha	16 0	3	5 10	27	4 5
Leavenworth	21 0	13 to 15	5, 5	4 to 9, 27	5 0
MISSISSIPPI.					
St. Paul	14 6	11, 12	2 10	9	2 1
La Crosse	10 0	14	3 5	19	1 0
Dubuque	21 10	16 to 17	4 8	21	2 8
Davenport	15 0	29	7 1	20	1 7
Keokuk	14 6	16	4 2	23, 24	0 7
St. Louis	30 6	15	6 10	29	3 10
Cairo	40 0	14	10 8	29	5 0
Memphis	34 0	15, 17	11 2	1	4 0
Vicksburg	41 0	23	17 6	4 to 6	7 11
*New Orleans	— 2 6	30	11 1	6	14 0
OHIO.					
Pittsburgh	30 0	1	8 9	27	0 7
Cincinnati	50 0	7	10 10	1	1 2
Louisville	24 0	8 and 9	8 9	1	2 0
CUMBERLAND.					
Nashville	40 0	11	13 11	27	2 10
TENNESSEE.					
Chattanooga	31 0	30	13 6	1, 2	1 3
MONONGAHELA.					
Morgantown	20 0	30	13 9	14, 19	1 3
Pittsburgh	20 0	1	6 6	27	0 7
SAVANNAH.					
Augusta	—	30	11 7	4	3 1
WILLAMETTE.					
Portland, Or		9	17	27	9 11

*Below high water mark of 1874.

DER OF THE SECRETARY OF WAR.

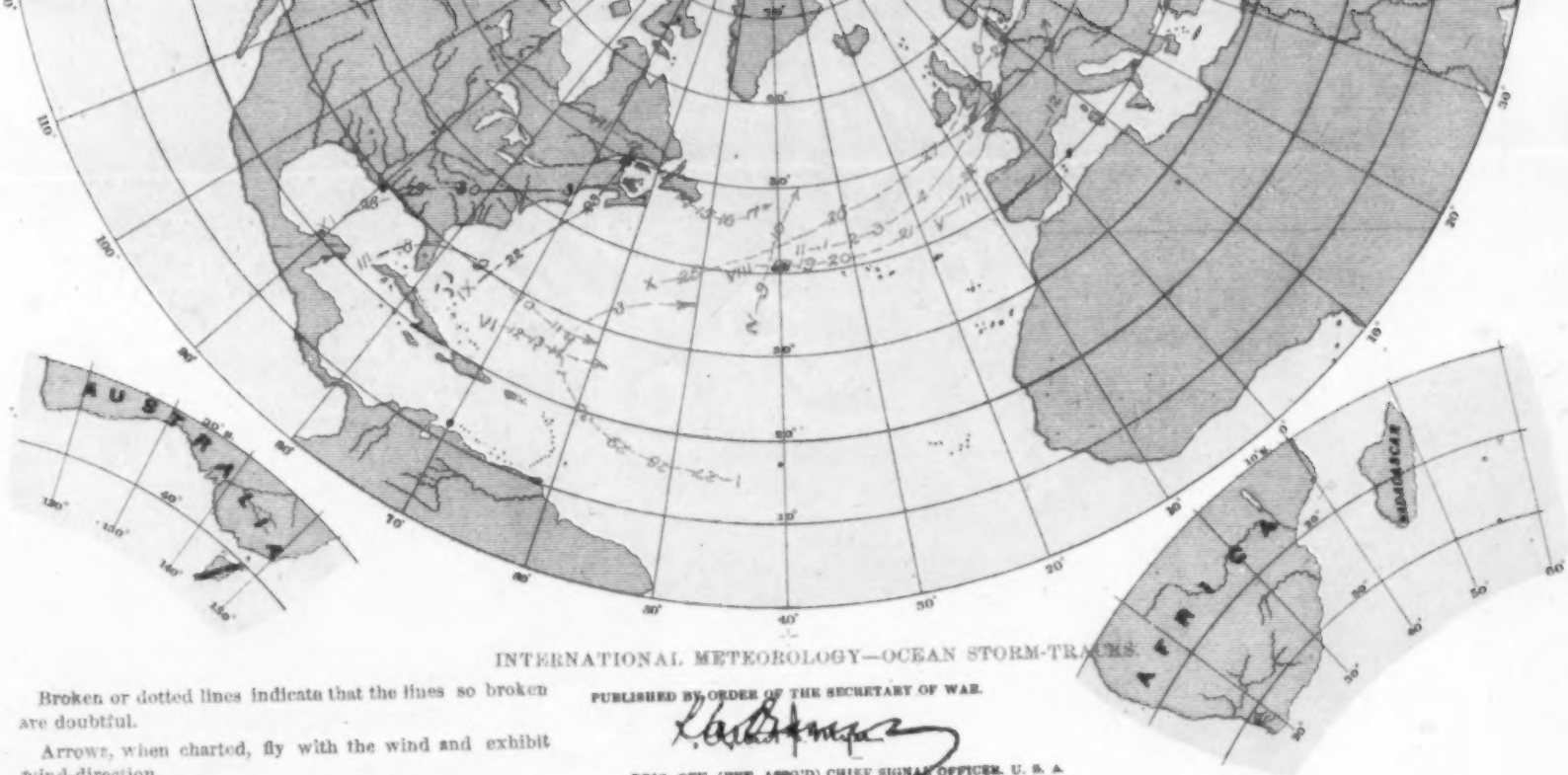
ND ACTING CHIEF SIGNAL OFFICER U. S. A.

GOVT. PRINTING OFFICE

CHART No. IV.

INDEX TO STORM-TRACKS.

No. I, from Sept. 27 to Oct. 5, 1880.
II, from Oct. 1 to Oct. 7, 1880.
III, from Oct. 8 to Oct. 11, 1880.
IV, from Oct. 9 to Oct. 10, 1880.
V, from Oct. 11 to Oct. 13, 1880.
VI, from Oct. 12 to Oct. 16, 1880.
VII, from Oct. 12 to Oct. 17, 1880.
VIII, from Oct. 18 to Oct. 23, 1880.
IX, from Oct. 22 to Oct. 30, 1880.
X, from Oct. 25 to Oct. 30, 1880.
XI, from Oct. 30 to Oct. 31, 1880.



INTERNATIONAL METEOROLOGY—OCEAN STORM-TRACKS.

Broken or dotted lines indicate that the lines so broken are doubtful.

Arrows, when charted, fly with the wind and exhibit wind-direction.

The tracks charted in black have appeared in previous *Reviews*.

The tracks charted in red have been made from data collected since preceding *Review*.

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

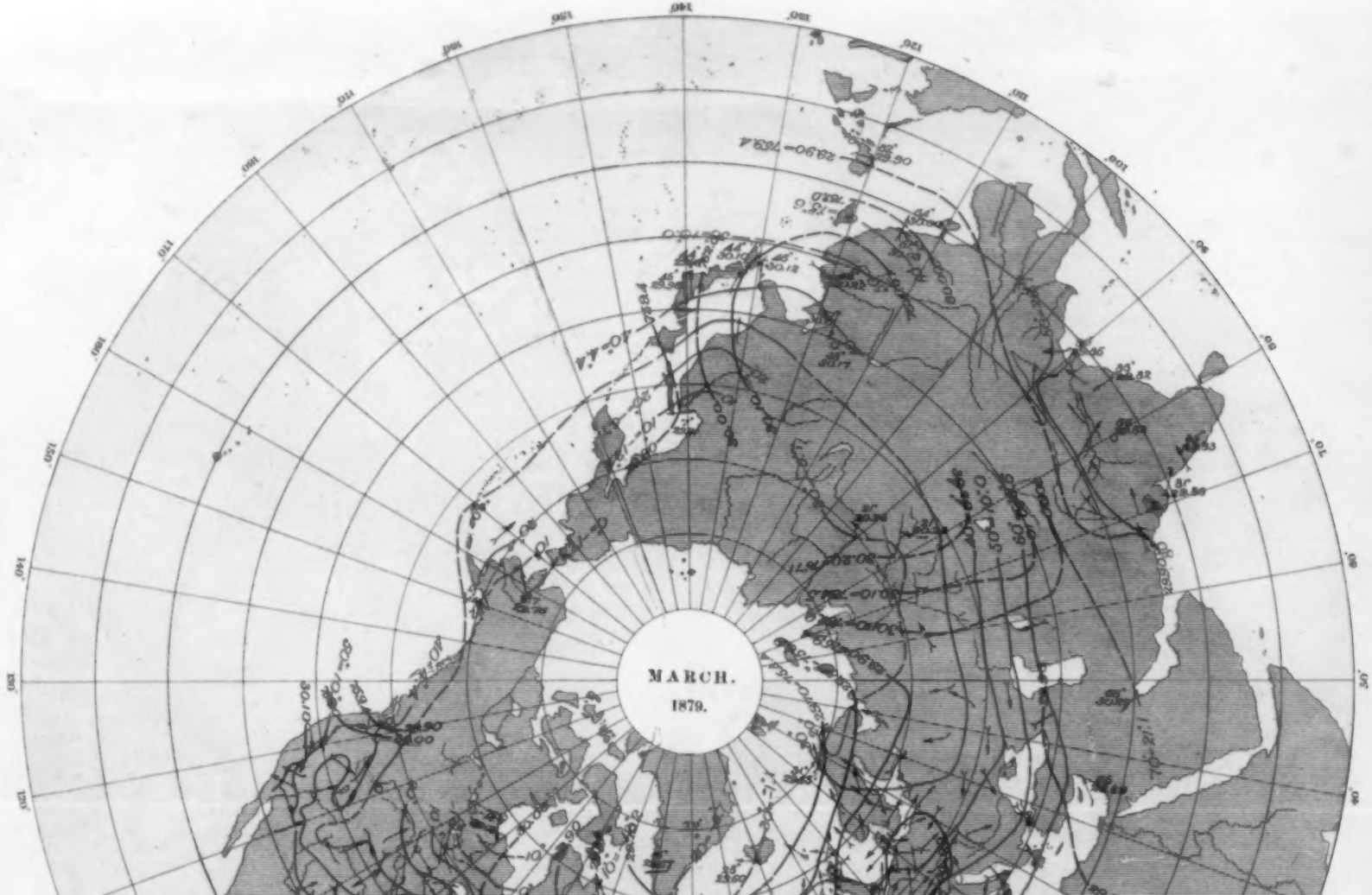
BRIG. GEN. (BVT. ASSG'D) CHIEF SIGNAL OFFICER, U. S. A.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

No. V.

Charted from Actual Observations taken Simultaneously. Series commencing September, 1877.



PREVAILING WINDS.

Arrows show the direction of, and fly with, the wind.
Force is shown as follows:

Symbols.	Force.	Velocity.	
		Miles per hour.	Metres per second.
	1, 2	0 to 9	0 to 4.0
	3, 4	9.1 to 22.5	4.1 to 10.1
	5, 6	22.6 to 40.5	10.1 to 18.1
	7, 8	40.6 to 67.5	18.1 to 30.2
	9, 10	67.6 up.	30.2 & over.

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ISOBARS AND ISOTHERMS.

Isobars in *blue*; detached barometer means in English inches.

Isotherms in *red*; detached temperature means in degrees Fahrenheit.

Broken lines, are doubtful.

INTERNATIONAL MONTHLY CHART.

Shewing mean pressure, mean temperature, mean force and prevailing direction of winds at 7:35 A. M., Washington mean time, for the month of March, 1879, based on the daily charts of the International Bulletin.

Office of the Chief Signal Officer,

UNITED STATES ARMY.

Charted from Actual Observations taken Simultaneously, Series commencing October, 1877.

No. VI.

Storm-tracks in *Black*. The Arabic numerals show location of the centres of Low Barometer, at 7:35 A. M., Washington mean time, of that date.

Broken or dotted lines, are doubtful

PUBLISHED BY ORDER OF THE SECRETARY OF WAR.

Adjt. Genl. and Asst. CHIEF SIGNAL OFFICER, U. S. A.

INTERNATIONAL CHART.

Showing Tracks of Centres of Low Barometer for March, 1879.